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# ALASKAN ESKIMO EXPLOITATION OF THE SEA ICE ENVIRONMENT

Richard K. Nelson

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ARCTIC AEROMEDICAL LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
FORT WAINWRIGHT, ALASKA

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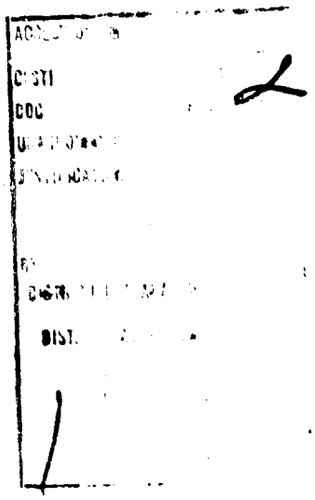

# ALASKAN ESKIMO EXPLOITATION OF THE SEA ICE ENVIRONMENT

Richard K. Nelson

## FOREWORD

This report was prepared under contract AF 41(609)-2613 (Project 8238, Task 823802) with the Department of Anthropology, University of Wisconsin, Madison, Wisconsin. The report covers research carried on from 1 October 1964 through 1 October 1965. Air Force program monitor is Dr. Frederick A. Milan, ALRE, Arctic Aeromedical Laboratory.

The author is grateful to Dr. William S. Laughlin, Department of Anthropology, University of Wisconsin, who, as principal investigator, gave his enthusiastic support and continual guidance. The author also thanks Dr. Frederick A. Milan, Environmental Protection Branch, Arctic Aeromedical Laboratory who initiated this study, and Dr. Kenneth I. Taylor, Department of Anthropology, University of Wisconsin, who provided assistance and advice. Additional support was given by the Arctic Research Laboratory under direction of Dr. Max Brewer. The author is indebted to this Laboratory for providing excellent facilities during his stay in the Arctic. Mrs. Carol Knott, University of Wisconsin, ably handled the business and administration of the project. The author thanks Mr. and Mrs. G. Ray Bane, B.I.A. teachers for three years at Wainwright, Alaska, and now affiliated with the Department of Anthropology, University of Wisconsin, for their knowledgeable and perceptive advice as well as for their kindness and hospitality.

The author is indebted to the people of Wainwright, Point Hope, and Barrow, Alaska, for the teaching and companionship which made his stay there so enjoyable. Mr. Waldo Bodfish gave generously of his time and knowledge, and the author is grateful to him and his family for their friendship and hospitality. Mr. Wayne Bodfish was an excellent friend and teacher. Mr. and Mrs. Weir Negovanna and Mr. Burrell Negovanna were also especially helpful and kind. The author thanks Mr. Wesley Ekak, Mr. David Bodfish, Mr. Raymond Aguvuluk, Mrs. Glenn Shoudla, Mr. Alva Nashoalook and Mr. Peter Tagarook, who contributed so much to making his stay in Wainwright an informative and enjoyable one. In Point Hope, invaluable assistance and hospitality were given by Mr. and Mrs. Antonio Weber. The author wishes to give special thanks to Mr. and Mrs. Bob Tuckfield of Point Hope and Mr. Pete Sovolik of Point Barrow.

This technical report has been reviewed and is approved.

Horace F. Drury

HORACE F. DRURY
Director of Research

## ABSTRACT

Studies were conducted mainly at the Eskimo village of Wainwright, Alaska, with supplementary research done at Point Barrow and Point Hope. A primary aim was to gather information concerning survival on the sea ice by a systematic study of both contemporary and traditional Eskimo hunting, travel, and other sea ice practices. Principal emphasis of the study was on observation and participation, with informal interviews utilized whenever actual hunting and travelling were not going on. The author lived as closely as possible to the native pattern. Data is organized in terms of environmental phenomena or "stimuli" likely to occur in the Arctic, and activities or "responses" which the sea ice traveller must make in order to cope with these external forces or to utilize resources which the environment provides. These forces are divided into (1) physical environment, including temperature, wind, atmospheric phenomena such as clouds and snow, astronomical phenomena such as sunlight and aurora, and sea ice; and (2) biological environment which the Eskimo exploits on the sea ice, including invertebrates, fish, birds and mammals. Since the Eskimo has become exposed to "outside" influence, much of the traditional culture is being lost, and the introduction and use of firearms caused revolutionary changes in hunting methods. Today the Eskimo combines traditional and modern practices in surviving in and exploiting the sea ice environment.

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## PHONOLOGY

The phonemic system utilized was adopted from that of Mr. D. H. Webster, who conducted extensive research in Wainwright under the auspices of the Summer Institute of Linguistics. Approximate sound values are as follows:

a = a in idea or u in but

e = e in bet

i = ee in feet

o = o in tone

u = oo in tooth

ch = similar to ch in much

g = a voiced spirant (ɣ)

ġ = a back velar spirant, farther back in the throat than g above (ɣ̇); sometimes similar to French r

h = similar to German ch in ach

ḳ = back velar stop, contrasting to English k (traditionally represented as a g)

l̤ = similar to l in million

ɬ = voiceless l followed by a voiced l

n̥ = similar to n in onion

ŋ = similar to ng in sing

z = retroflexed alveolar sibilant

Phonemic values of the letters k, l, m, n, p, s, t, v, w, and y are approximately the same as in English. The letters b, c, d, f, q and x are not used.

# I

# INTRODUCTION

This study of Alaskan Eskimo exploitation and knowledge of the sea ice environment was begun during the spring of 1964. At this time a survey was undertaken of the literature dealing with Alaskan Eskimos, as well as selected materials covering neighboring Eskimo groups. This study utilized the better known works, such as those by Thornton (1) and Nelson (2) on the Bering Strait Eskimos, Foote (3) and Van Stone (4) on Point Hope, Spencer (5), and Murdoch (6) on the Point Barrow area, and especially the very important material by Stefansson (7, 8). In addition to these larger works there are numerous other reports, some of which contain excellent observations regarding the subject of study. This report was written in August 1964, just before the beginning of the field study.

The purposes of this preliminary study were twofold: first to obtain a background knowledge from which to fully understand the problem, as well as to aid in conducting an ethnographic study; and second to compile a body of data which might offer a significant addition to that which would be obtained from the Eskimos themselves. The writer feels that this preliminary study was indeed an aid in both of these areas, particularly in the formation of an adequate understanding of the problem beforehand. Frequent reference will be made to the study in the accounts which follow, since much of the basic information was introduced there. Immediately preceding the field study, the writer spent a briefing period in Fairbanks, during which time Dr. Frederick A. Milan and others at the Arctic Aeromedical Laboratory gave advice and information.

The principal village in which the study was conducted was Wainwright, Alaska, from September 1964 through April 1965. Supplementary research was done during several brief periods in Point Barrow, and during May at Point Hope. This report is derived largely from that research, and was prepared during the two and one-half months immediately following return from the field.

## Aims of the Research

Anyone who has studied the Eskimo or the Arctic knows well that there is a relatively great volume of literature available dealing with these interesting people. Murdock's Ethnographic bibliography of North America (9), which is primarily concerned with social structure, lists for example over 100 references for the North Alaskan Eskimos, over 130 for the West Alaskan Eskimos, and 150 on the West Greenland Eskimos. The small

group of about 300 Polar Eskimos alone has over 90 references listed. Pilling's Bibliography of the Eskimo language (10) lists 177 references published between 1656 and 1828. In addition to these there are any number of works for each area such as early explorers' accounts, and those by missionaries, teachers, and adventurers.

In spite of this abundance of literature, and in spite of the fact that culture change has diminished the amount of knowledge still retained by these groups, there is an unlimited amount of data to be gathered which is not yet found on any written page. Ethnographic materials presently available are largely general and do not deal with each area of knowledge in enough detail to satisfy research and utilization needs, and the other accounts are mainly anecdotal rather than systematic studies of any aspect of native culture. It is therefore important to conduct direct and systematic descriptive ethnographic investigations.

Detailed and intensive studies of particular aspects of Eskimo culture have indeed been undertaken, particularly in the realm of linguistics, social structure and, in some cases, material culture. This study concentrated upon Alaskan Eskimo exploitation and knowledge of the sea ice, a study of environmental adaptation of a very specific nature. A systematic field study of travel and hunting methods, and a simultaneous investigation of traditional knowledge of survival, methods of travel and hunting was made.

The value of such a study is both intrinsic and practical. Descriptive research is valuable in that significant contributions can be made to areas of knowledge outside of ethnology. The Eskimos have acquired an intimate knowledge and understanding of their physical surroundings, in which they must travel and hunt daily, and of their biological environment, to which they must respond in order to maintain their existence. It is therefore possible to make contributions in the fields of meteorology, physics, geology, glaciology, botany, marine biology, ethnology, ecology and others through this type of ethnographic study. Considerable amounts of ethnographic data have not yet been recorded, and it should be of paramount interest to collect this information before it is irrevocably lost.

A primary aim of this research was to gather information relative to survival on the sea ice by a systematic study of both contemporary and traditional Eskimo hunting, travel, and other sea ice practices. This study is by no means exhaustive, for there is such a large body of knowledge concerned with this subject alone that only the basic facts can be collected in such a brief period of time. During a field study focussed on actual behavior, one becomes acutely aware of the fact that a residence of many years would be required in any one village in order to do a really

complete study, and even then the surface would only be scratched. Every locality and every village provides the opportunity for comparative studies.

## Method of Study

The methods employed in the gathering of information from the Eskimos should be understood, for these methods depend primarily upon direct observation.

In late August 1964, the author was flown into Wainwright. He was alone and knew no one in the village, but was identified in part by Dr. Frederick Milan, who had lived in the village and published an initial study on it. The initial problem was settling in the house provided by the Arctic Research Laboratory and, of course, getting acquainted with the villagers. As one would expect, the initial reaction of the people was one of reserve, which gradually gave way to "acceptance" over the weeks and months of the author's residence. Newcomers and outsiders appear to be regarded with reserve no matter what their business may be in the village, but certain factors can increase or diminish this reaction. School teachers, traders and missionaries have been visiting North Alaskan villages for many years and have come to be regarded as something "normal". However, the advent of the resident scientist and student, though earlier, is certainly a much less frequent occurrence. Any sort of person appears to be greeted with somewhat greater reserve than the "normal" visitor or temporary resident, if he is continually asking questions. This is especially true if they concern things which do not seem to be important, or are on sensitive areas. The writer scrupulously avoided interrogation of any sort.

Another factor influencing the degree of reserve with which one may be faced and the rapidity with which this reserve breaks down has to do with marital status. It appears that visitors who are married individuals, particularly if the spouse is present and even moreso if there are children in the family, are confronted with much less reserve than are individuals who are alone or unmarried. The latter are considered perhaps as a bit abnormal by the older adults, and as potential competition by the younger adults of the same sex. Very frequently during the writer's stay he was asked why he was not married, if he would get married soon, and whether or not he might marry an Eskimo girl.

The most common questions asked of the newcomer are, "What are you here for?" and "When are you planning to leave?" This latter inquiry may be a bit disconcerting at first, but no attempt to hasten the departure appears to be intended. The writer was, from the very first, quite candid

and straightforward regarding his purpose in the village, especially since the nature of his interests were fairly easily understood by the villagers and regarded as important.

Perhaps this was one of the most important factors in the establishment of rapport in the village: the fact that no particular interest was shown in matters which are regarded as taboo for discussion in the presence of non-natives. These include many aspects of the aboriginal culture which have been regarded as "primitive" or "immoral" by outsiders and missionaries. An investigation of hunting practices, travelling, knowledge of sea ice, and survival does not require any probing into such private matters and it is therefore not necessary to risk becoming offensive.

The subjects being studied are, in fact, matters of considerable importance and interest at the present time, and not of a type which might be regarded as trivial. These practices are, furthermore, not simply recounted from memory, but are skills which modern Eskimos still possess. It is a matter of pride to the people that they are able to carry these out successfully, and particularly so when they are in the position to demonstrate these skills for someone who has not mastered them but is interested in learning. Thus the Eskimo is in the position of authority -- a position often denied him in modern times with non-natives. In this case he is in a position of being helpful with technical information and providing essential survival information of a practical nature.

In order to observe these techniques the investigator must accompany the Eskimos as the practices are actually carried out each day in order to see and to truly understand them. The Eskimos are therefore able to know that one appreciates firsthand what is involved -- what it is like to be cold and exhausted, and how much skill and knowledge is required in order to put techniques into actual practice. Because of this, the principal emphasis of the study was on observation and participation, with informal interview as a backup method, utilized whenever actual hunting and travelling were not going on. There was little need for paid informants. This method was shunned because it was felt that to pay persons would seriously detract from the value of the informal interviews. Notes were written each evening, usually quite late, or immediately following return from a hunting trip or productive interview. No taking of notes was done in the presence of informants except for isolated occasions when important Eskimo words were written or when brief notes were taken while the author was camped away from the village.

A great deal of time was spent outside of the writer's place of residence, hunting and travelling with Eskimos, and also visiting Eskimo households. Shortly after arrival in Wainwright, the writer purchased a dog team. It was possible, therefore, to gain a knowledge of dog training

practices and all aspects of dog team use. Without the use of one's own team it would be utterly impossible to actively participate in, or observe, hunting practices on the sea ice, which is largely a matter of individual pursuit. It was also possible, by constructing a dog sled and various items such as lines and harnesses, to appreciate more fully the problems and methods involved. By using the dog team, the author could learn each type of land and sea hunting technique, and could make observations of many individuals during a single day.

In addition to construction of items of use for the dog team, the writer made all of his sea ice hunting gear, including a kayak. With the assistance of various individuals, this was done in the house furnished by the Arctic Research Laboratory, which served well as a workshop. While the writer worked on such equipment, or assisted others on similar projects, considerable information was obtained regarding not only the problems of constructing native implements, but also on a wide range of additional materials. An overt attempt was made to be self-sufficient in all aspects of residence in the village, to live as close as possible to the native pattern. This involved hunting and travelling, constructing equipment, procuring food and drinking water, learning skills of food preparation, wearing native clothing made by women in the village, visiting, and being visited.

For the most part informal interviews were conducted during daily visits to various households, and in the native store, and coffee shop which serve as local gathering places. Living alone offered the advantage of being able to conduct activities such as those listed above, and to carry on uninterrupted sessions with visitors, and to have privacy for note-taking. However, there would have been advantages to living with an Eskimo family, such as acceleration in learning the language and perhaps additional opportunity for inquiry into matters of interest.

In line with conducting native activities it was possible to make an informal study of the language, although no concerted attempt was made to learn it conversationally even if this were possible in such a short residence. The language is important, and a fluent understanding of it would greatly facilitate this or any study in a North Alaskan village. Essentially all of the people speak good English and in only a few instances was an interpreter needed. Eskimo is the language used in normal conversation and a great deal of information could be picked up by a person understanding it. The writer found that his interest in the language, and ability to understand and speak certain simple constructions was more of an aide to establishing rapport than to gathering information in the native language.

This was of particular importance during the brief month-long residence in Point Hope, since there was very little time to become established there. The writer was impressed by the fact that a residence of at least

several months should be undertaken if any real study is to be conducted in a particular village. However, several factors besides an elementary knowledge of the Eskimo language were helpful toward making the brief stay in Point Hope a profitable one.

More important than the language was a knowledge of the "way of life"; knowing what to do in social situations and how to travel and hunt without depending upon others is almost an essential. In addition to being knowledgeable as to the Eskimo way of living, the writer also found it helpful to share mutual acquaintances with the Point Hope people, such as individuals in Wainwright and Point Barrow who had come from the Point Hope region or had relatives there.

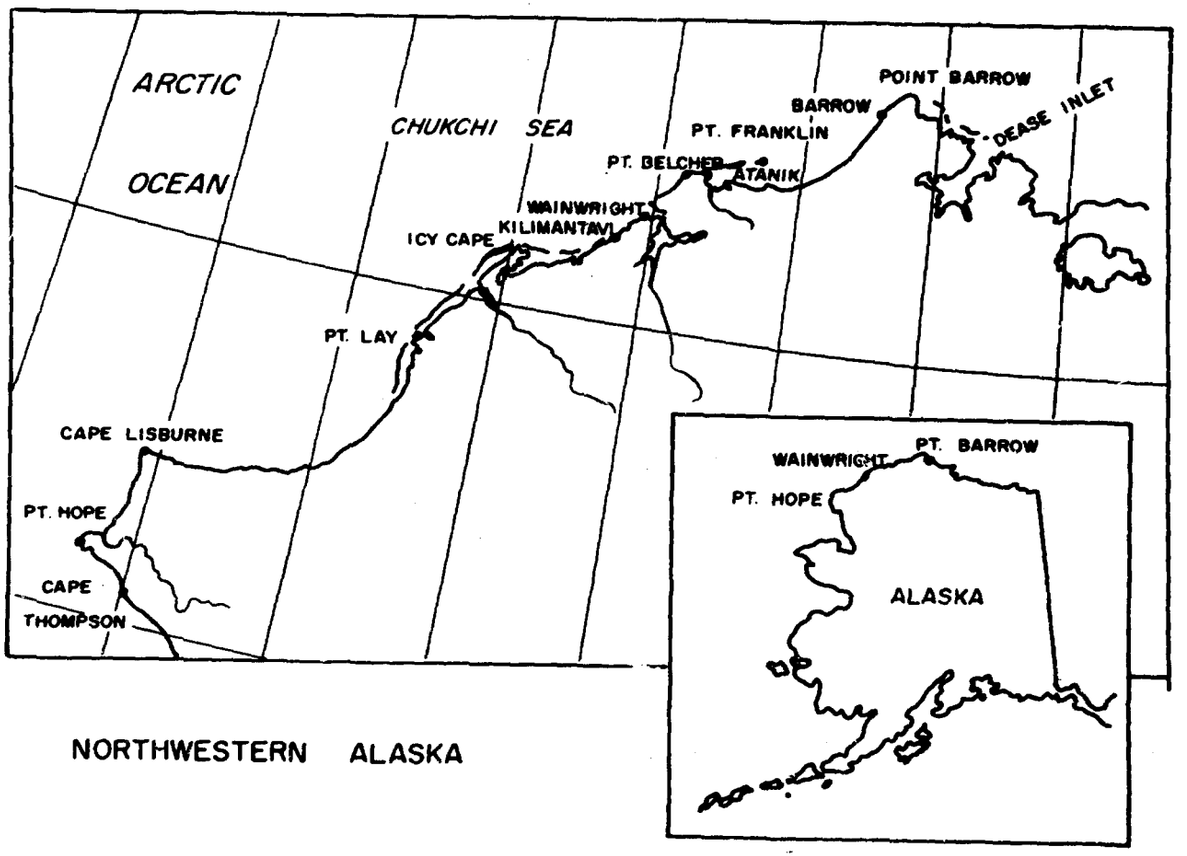
In Point Hope, besides time spent out on the ice in the whaling camps, the greater proportion of effort was put into visiting a few households where the members were particularly friendly and knowledgeable. In this way it was possible to collect a sizeable body of data since there was very little shyness and reserve after only a few visits. For brief stays such as this it would perhaps be profitable to utilize paid informants, although in this case it was not done.

## Description of the Region

The Arctic Coast of Alaska may be said to include the long, featureless coastline stretching from Barter Island in the east to Point Hope in the west, with Point Barrow forming the northern-most extension about midway between the two extremities. From the standpoint of this study the area may be divided into two sections, the eastern section being all of the coast east of Barrow as far as Barter Island, and the western including the coast from Point Barrow to Point Hope. The eastern section will not be of much importance here since there is only one modern settlement, that at the far eastern end, and because the ice conditions more closely resemble those to the east in Canada.

The eastern portion of the Arctic Coast is an area of relatively slight ice movement during the winter, the ice lying still and in great flat ice deserts for many months of the year. These conditions give rise to somewhat different ice hunting adaptations and require less caution by travellers than the area west and south of Barrow. This eastern area was formerly very sparsely populated, with only temporary campsites utilized primarily by residents of Barrow (5).

In contrast to this, the region between Point Barrow and Point Hope is relatively heavily populated, with four settlements in existence today.




NORTHWESTERN ALASKA

Formerly, however, there were small village and camping sites spaced all along this coastline, including two villages at Point Barrow, and villages at Atanik, Point Belcher, Wainwright, Icy Cape, Point Lay, Cape Lisburne, and Point Hope. Scattered between these larger villages were isolated houses or small seasonally-used village sites such as Pihasuguruk, Killamentaġvik, near Wainwright, and Utokak near Icy Cape. In addition to these established points of inhabitation there were temporary campsites everywhere along this coast.

Although the ice in the larger bays and indentations along this section of coastline, such as Peard Bay and the area north of Icy Cape, did remain fairly flat and unmoved all winter long, most of this entire region has considerable ice movement. One can expect to have leads opening periodically during the winter, often quite close to the land. Along with this ice movement, and undoubtedly partly because of it, there is a rich and easily exploited marine resource through the winter. Thus there are settlements concentrated, especially in recent times, around the points and headlands, where ice movement is increased and there is heavy dependence upon the sea for a livelihood. Along with richness of the sea there are, however, special problems of safety and travel, and in this region there has developed an elaborate knowledge of the sea ice and of exploiting this very special type of environment.

The modern village of Barrow is located at 71° 18' north latitude and is the northernmost Eskimo settlement in North America. It is situated several miles south of the point itself but is just above the beach. The hunting economy is today secondary to a rich cash economy made possible by active development of the area by the Office of Naval Research, the Bureau of Indian Affairs, and others. Thus the greater majority of the inhabitants work a six-day week and hunt only on days off. Those who do hunt on the ice here find a rich resource of seals, and in the spring there is still a fairly active whaling effort. The ice is very mobile due to strong currents, deep water, and the fact that the village is near to a point, so that there are often open leads offshore and the ice here is considered dangerous.

Ninety miles south of Barrow (air distance) is the village of Wainwright, located 70° 40' north latitude, 159° 50' west longitude. Wainwright is also situated right on the coast atop the 20-foot high cliffs behind the beach. There are some 300 inhabitants in the village living in about 44 households. Viewed from the air it is a compact grouping of small frame houses with numerous wooden caches spread about, and an uncommonly large number of tall wooden poles scattered everywhere. On the ground one realizes that these poles are mostly used to support radio antennas, one for every house, and also to string lines or racks for drying clothing and skins.

The houses are mostly one or two rooms crammed full of the necessities of life but containing little else. Normally there is a sleeping room or section and a room or area in which the cooking and heating stove is located, where the meals are eaten and visitors are entertained. Some houses are larger, having several rooms and occasionally two stories, and some are exceedingly small and crowded. Outside the heated section of the house is the hallway or kanichak, which serves as a general storage area for equipment and furs, and is often very long and low, with one or more doors to go through before reaching the entrance to the heated portion of the house. The houses have one or more windows in varying states of transparency due to the plastic coverings which are often used to make a double pane effect.

The Wainwright people are fortunate in having natural outcroppings of coal both inland along the Kuk River and offshore, so that most individuals are able to sack their own coal and haul it to the village by dog team from one of three coal mines or from the nearby beach where it washes up during the fall storms. This coal is burned in stoves both for heating and cooking purposes, although cooking also may be done on gasoline-burning camp stoves.

The Wainwright people are therefore able to save much of the money which they earn by summer employment or by the sale of goods such as walrus ivory, and which is given to them in the form of monthly unemployment or welfare checks. They can use it for purchasing clothing, hunting equipment, and food from one of two local stores. They have become heavily dependent upon such goods, brought in on the annual Bureau of Indian Affairs (B.I.A.) supply ship Northstar or ordered by mail from outside, and would no longer attempt living without these goods.

In spite of the availability of food at the local stores, the people still depend upon hunting for their economic mainstay. Their main diet is basically derived from the surrounding land and sea, and during the colder months they wear parkas, boots, and other items of clothing made from animal skins. Wainwright is situated in a position which permits exploitation of a very rich land and marine resource, unlike some villages which specialize more in one or the other. During the fall, spring and summer, huge migrations of caribou provide a land resource much larger than most coastal villages are able to exploit. In the sea there are herds of walrus in the summer, seals in the winter and spring, and migrations of waterfowl in the spring and fall. And in the rivers and lagoons there is a large exploitable resource of fish. The people are able, therefore, to turn from one resource to another should it be necessary to do so.

Wainwright village is located on a peninsula of land bounded by the Chukchi Sea on one side and by the huge Kuk River on the other. The Kuk, which means "river" in Eskimo, is actually a submerged lagoon which is salt water until one is perhaps 50 miles inland from the mouth. It is the Kuk River which is used for travel inland, during the summer by boat and during the fall and winter by dog team.

Since Wainwright is not on a point, the ice does not move as easily nor as rapidly as it does at Point Barrow or at Point Hope. During the winter and spring, however, the ice moves whenever there is a fairly strong breeze and/or when the current is flowing swiftly. Thus the ice opens to form leads periodically, enabling the hunters to travel out to the edge for seals, and when the ice closes tightly the men go out far from the land in pursuit of polar bears. But this will be dealt with in detail later in the report.

The Wainwright people call themselves the Ulġunigamiut or the people Ulġunik. They feel more closely related to the people to the north -- the Utkeavinmiut or people of Barrow. Frequently during the summer the men go to Barrow for employment, and during the season of dog sledding they travel north to visit their many relatives. Since the advent of commercial air service on the coast the people commute more easily, and the more affluent Barrow people come down to visit Wainwright as well. There is a good deal of village pride and identification however, and the Wainwright people do not appear to be attracted to the "opportunities" for employment and drink at Barrow in large enough numbers to make inroads into the Wainwright population.

With the people to the south, Point Lay, 100 miles distant, and Point Hope 180 miles away, the Wainwright Eskimos have only sporadic and casual contact. This holds true also for the more distant village of Kaktoġvik at Barter Island, about 400 air miles. The Wainwright people have friends and relatives in all of these villages, and visiting both ways is sometimes done, but Wainwright is much more closely associated with Barrow.

A great deal more information could be given regarding the general conditions at Wainwright, where the major portion of the study was conducted. Indeed, throughout the text there will be reference to the present-day situation, particularly regarding the economic life and methods of hunting and travel in use there. The village, being heavily dependent upon a hunting economy, being isolated and rather conservative toward cultural change and offering several advantages for ethnographic study, was selected as the main area in which to conduct this research.

The location proved to be excellent for sea ice studies, since it possesses both the characteristics found in places where the ice seldom moves and in those where the ice is frequently in motion. Therefore, the characteristics of sea ice far out on the polar pack as well as within the dangerous areas of ice motion could be observed, since both types of conditions are important for sea ice survival.

The village of Point Hope (68° 20' N, 156° 47' W) is approximately the same size as Wainwright, with perhaps 350 inhabitants. It is located near the end of a very large spit which juts out approximately 15 miles from the mainland between Cape Lisburne and Cape Thompson. The physiognomy of the village is also very similar to Wainwright except that the houses are much more spread out and are aligned along several parallel beach ridges.

The people of Point Hope, called the Tikegaagmiut, are also dependent upon hunting for their subsistence base, there being little employment within the village other than the sale of native goods and skins. However they are much more dependent upon the sea and much less on the land for their hunting. The Point offers an excellent location for ice hunting, with open leads very close to the village all winter and spring and an abundance of seals and whales. In the summer and fall, however, when the ice is gone and the game is scarce, many of the men seek employment in larger villages to the south or in Fairbanks. It is therefore a rich, but perhaps less well-balanced economy than that of the Wainwright people.

The ice conditions around Point Hope are highly mobile and very dangerous. The ice here moves constantly before the force of gale winds and powerful currents, causing huge piles of jumbled ice which make dog team travel very difficult, though the distance to the lead is usually short. The Point Hope people are experts of ice lore, perhaps more so than any other north Alaskan settlement, and they are probably more conservative in attitude toward technical and cultural change than the Wainwright Eskimos.

Point Hope maintains closest ties with villages to the south, particularly Kivilina, Noatak, and Kotzebue, and the only closely associated village to the north is Point Lay, about 90 air miles distant. This settlement is very small, consisting of only two or three families, and is said to be an offshoot population of Point Hope natives who moved north around the turn of the century. The Point Lay people are said to depend mostly upon employment at the nearby military installation for their economy. The village is located on a headland but is apparently well enough protected by Cape Lisburne to the south that ice movement is not very great. The climatic statistics for the village also imply a more inland situation than any of the other north Alaskan villages with the exception of Barter Island.

## Organization of the Field Report

The organization of this report is the same as that which was used in the preliminary report Literature review of Eskimo knowledge of the sea ice environment prepared by this writer in 1964 (11). In both reports the data is organized in terms of "environmental phenomena or 'stimuli' which are likely to occur in the Arctic, and the activities or 'responses' which the sea ice traveller must make in order to cope with these external forces or to utilize the resources which the environment provides".

In this way we consider, for example, the single phenomenon of cold. After the temperature characteristics of the coastal Arctic environment are summarized, the types of responses which the Eskimos make to cold are described. These may include clothing, shelter, fire, and so on. Furthermore, should the response be inadequate or incorrect there are secondary effects such as inability to travel or frostbite. For these secondary effects there are also a series of responses. The Eskimos are affected by the cold in many ways besides simply the provision of warmth, since the consistency of snow, activities of game and other important factors are dependent upon the temperature.

"The author has segregated a series of external forces and resources, and has suggested one or several ways to deal with them. These are divided into physical environment and biological environment." (11) The first includes temperature, wind, atmospheric phenomena such as clouds and snow, astronomical phenomena such as sunlight and aurora, and the sea ice. The second includes the energy sources which the Eskimos exploit on the sea ice, including invertebrates, fish, birds, and mammals.

The first few chapters will deal with the physical environment of the Arctic sea ice and the methods known to the Eskimos for dealing with it.

# II

# TEMPERATURE

## Temperature Characteristics and Forecasting

The dominant feature of the Arctic environment is its climatic extremes and the most important aspect of this climate is the temperature. The area with which we are concerned, coastal settlements and the sea ice, is one of marked maritime influence. Temperatures are therefore warmer in the winter than are those characteristic of inland stations considerably farther south, but they are also much cooler during the summer.

The degree of marine influence on the temperature regime varies considerably during the winter according to local sea ice conditions. In areas of slight ice motion the climate is apparently more continental, with more intense cold than areas in which the ice opens and moves frequently throughout the cold season.

> The vast ice layer covering the Arctic Ocean in wintertime has a pronounced effect upon the climate of the Arctic Drainage Division (which includes Northwest Alaska), particularly upon that portion which lies north of the Brooks Range. After ice becomes fast to the shoreline and the open water virtually disappears for the winter season, the maritime influences are greatly diminished.. .. some heat appears to escape through the ice covered surface to prevent low temperature from reaching the extremely cold readings realized over the mainland areas of the Interior Basin (12).

By no means can the temperature be considered balmy, summer or winter. At Wainwright, Alaska, for example, the annual mean temperature is plus 11.7° F, which is comparable to the average for the coldest month in Wisconsin. The mean temperature for July at Wainwright is plus 43.6°, and the maximum recorded was plus 78°. The coldest month is February, with a mean temperature of minus 17.9° and a minimum recorded temperature of minus 51°. During the winter of 1964-1965 this temperature was equalled twice, and during the preceding winter a low of minus 57° was recorded in Wainwright.

These temperature figures compare fairly closely with those for neighboring stations north and south along the Arctic Coast in Alaska. Annual mean temperatures are: Point Hope plus 18.7° F, Point Lay plus 13.3°, Point Barrow plus 10.1°, and Barter Island plus 10.6° (13).

During the winter of 1964-1965 the temperatures at Wainwright were exceptionally cold, particularly during December, January, and February. Temperatures for these three months averaged 10° or more below the normal mean, which in some ways made conditions for this study more favorable. Due to the cold temperatures, which held at minus 25° to minus 40° F for weeks at a time, more opportunity was afforded to observe cold weather precautions and techniques. In addition there were a fairly large number of stormy days, when heavy winds increased the effects of cold temperatures and created other problems of survival.

It should be mentioned here that in the Arctic, though the temperatures do not reach extremes of cold, the winds make the climate infinitely more

severe than that of the calm inland regions. Thus temperature "equivalents", i.e., the temperature equivalent under calm conditions, reach the minus 90° to minus 120° range rather frequently (USARAL Chart 20-12, 11 June 1964, #4636-64). In these great flat expanses of tundra and ice the winds of the all-too-frequent storms blow unobstructed for hundreds of miles, but the Eskimos must travel and hunt in spite of them.

Because their activities are so heavily influenced by the weather, the Eskimos have developed effective methods of weather prediction. Knowledge of weather has been inherited from previous generations and is passed on by the older men to the young hunters, but is also obtained by the accumulation of knowledge based upon the personal experience and observation of individuals themselves. It is not uncommon for an Eskimo to explain a fact or technique and then to tell how it was that he discovered this by his own observation or inventiveness.

During the winter the men are actually more concerned with the wind than the temperature, since it is the wind which causes the danger of frostbite or of becoming lost. They do not worry about the temperature dropping far below zero because when it is very cold it is usually clear and calm. In such cases the men watch for signs of continuing good weather, which means high and steady barometric pressure, winds fairly light from the north, northeast, or east, excellent visibility (unobstructed by haze), stars twinkling only slightly, and clear skies. If there are a few high clouds it is important to note the direction from which they are coming and their speed. Slow movement from the north or east quadrant usually foretells of continuing clear weather. Thus the Eskimo who plans to hunt or travel will check the weather in the evening or early morning before he sets out. Seeing these favorable signs he can plan to leave and to travel without danger, regardless of how low the thermometer may fall.

During these clear and cold days of midwinter the light easterly winds may hold the lead open offshore for days or even weeks at a time. In this region the current is largely controlled by the wind during the cold season, and the ice hunters know that when the current is moving slowly from the north or east the weather will probably be good. It is at this time that intensive hunting for seals is done along the edge of the open lead. Since seal hunting requires that the men remain out for three to eight hours at a time, or more when the days grow longer, they must wear some of their warmest clothing.

Clothing

In most cases this means that fur clothing is used, and dress for these activities approaches most closely the traditional types. However none of the Northwest Alaskan Eskimos observed during the winter of 1964-1965 were using a completely native outfit and there was considerable variation in the degree to which this was approached.

Perhaps the most important element of the hunting outfit is the footgear, and in this the Eskimos are closest to maintaining the aboriginal pattern. During the cold months, and up until the time that the ice and snow are melting, there is essentially one type of boot used for all sea ice activity. This boot, called ugurulik in Eskimo, is made of skin of the caribou (Rangifer tarandus) and bearded seal (Erignathus barbatus). The most important part of the ugurulik is the sole, which is made from the tough waterproof bearded seal skin with the hair removed.

These soles are prepared by first cutting two oblong sections from a skin. The hair is scraped off with skin scrapers, with the addition of abrasive material such as gritty soot from the coal-burning stoves. The soles are soaked to soften them, and then are crimped with flat-nosed pliers around the toe and heel so that they can be bent up to meet the caribou-skin uppers. When ready for sewing, each sole resembles a small open boat, now very stiff and hard from drying. If the skin has been allowed to rot outside during the summer, the hair can simply be pulled off by hand and the sole will be colored a light brown. If prepared by scraping, it will be black. The light-colored soles are preferred, probably because they are more easily made.

The boot uppers are made from the skin of the caribou legs, one boot requiring all four legs of a grown caribou, preferably one killed in the fall. When legs are skinned for boot construction, care must be taken to cut the skin as far down around the hoofs as possible, and to slit the skin down the front of the forelegs and down the back of the rear legs. The skins are then laid down on the snow to freeze flat and are taken home to dry inside the house. The skins will be dry in two or three days, although they must not be placed too close to a direct heat source lest they shed their hair easily. After they are dry they must be scraped until they are soft and pliable.

The legs are then sewed together, with the two foreleg skins forming the boot sides, one hind leg forming the rear and the other hind leg extending down the front and over the instep. The boot upper, which reaches to just below the knee, is then sewed onto the boot sole, with a strip of skin from ringed seal (Phoca hispida) between. Most of the sewing is now done

with dental floss, which is waxed and is very strong. Braided sinew formerly was used and is still seen in the better made boots, especially when waterproof seams are desired.

These ugurulik<u>s</u> are quite warm because of the caribou-skin uppers, but are preferred for sea ice use because the soles are waterproof. Sea ice, especially young ice of several days to two weeks formation, is always wet on the surface. This moisture will spoil caribou-skin soles, to say nothing of the fact that moisture soaking through the boots cause discomfort and possible freezing of the feet. In former years the skin of the beluga (Delphinapterus leucas) was used for boot soles, and is said to be tough and waterproof much the same as bearded seal. Around the top of the ugurulik is a thin strip of cloth, through which is threaded a drawstring. With this the boot can be closed tightly around the top, preventing snow from coming inside and sealing out water should the wearer fall through the ice.

Inside of the ugurulik there is always an insole. In modern times this is often a felt insole bought from the native store, but some men prefer to make their own from caribou skin, which is probably much warmer. In order to prevent these fur insoles from sliding out of place, they are made with the toe end turned up and over and sewed on the sides. If fur insoles are used, the wearer probably must have cloth socks of some sort. Usually several pairs of wool socks, and perhaps a pair of felt "booties" are worn.

In cold weather, however, it is much preferred to wear caribou skin "socks", called aleksie. These are simply boot liners made entirely of caribou skin with the fur inside, unlike the boots which have the fur outside. Caribou socks are made in two lengths most commonly to six or seven inches above the ankle but sometimes to the top of the boot. These are exceedingly warm and comfortable and offer several advantages over cloth socks, because should body or outside moisture soak cloth socks they will freeze into the boot and become impossible to remove for drying. Caribou will not freeze in, and is also warmer when damp than cloth.

It has been noted that Eskimo boots sometimes appear to be very tight fitting, such as in the statement by Thornton (1) that some young men are "...very particular about the fit of their clothes, especially as to the smallness and snugness of their boots; consequently it is to be feared that they sometimes suffer from cold feet."[1] However it is more probable that the boots themselves were not tight but the ankles were small. There is a tendency to make the boots taper at the ankle so that they will hold more tightly to the foot. This makes the boots rather difficult to put on, but there is always ample room inside for the feet. The Eskimos state

emphatically that footgear must not be too tight, and that there must be allowance for several pairs of heavy socks or for the caribou-skin boot liners.

Uguruliks, with their bearded seal skin soles, are not nearly as warm as the other important boot type which has caribou-skin soles. These boots are called tutliks, a word derived from tuttu which means caribou, just as ugurulik is derived from uguruk, the word for bearded seal. The tops of these boots are made in exactly the same way as the sealskin-soled boots, and in fact a given pair of uppers may be switched from one type of sole to another. The soles of the tutulik are made from the toughest skin of the caribou, which is dried and scraped, but of course has the hair left intact. The soles are sewed in three parts, cut so that they wrap around the foot and join the boot upper, which has the hair turned outside. There is no need for insoles with tutulik boots, since the thick fur is attached to the skin. Usually only cloth socks are required for use inside of these boots, since they are far warmer than the other type. In some cases skin of ringed seal (P. hispida) is sewed on over these soles, also with the hair turned inside, which not only makes the boots usable on the wet sea ice but also makes the boots warmer and the soles last longer.

Tutuliks are normally saved for use on inland hunting and trapping excursions, and for ice fishing, where maximum warmth is required and where the boots will not become wet. Very rarely a pair of tutuliks with sealskin covers sewed onto them will be seen in use on the ice. Since most ice hunting is done without camping out it is felt that the uguruliks are warm enough. Caribou-sole boots are also seldom used for walking around in the village because the soles wear through so much more rapidly than bearded seal.

Both types of boots have the soles treated with seal oil, particularly the sea ice hunting type. To do so protects them from moisture and apparently is necessary to prolong the life of the sole. Other than this the only important boot care is drying, and it is a very essential factor in maintenance of all skin footgear. Care is taken each night to hang up the boots, socks, etc., often on lines strung from the ceiling of the house. In this way they are dry before the beginning of each day, which increases their warmth and prevents early deterioration of the skin. Caribou hide sheds easily and must therefore be treated with care.

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[1] Reprinted from Among the Eskimos of Wales, Alaska by Harrison Thornton, by permission of Johns Hopkins Press. Copyrighted 1931.

Next in importance to footgear is the parka (atigi). For sea ice hunting the traditional caribou-fur parka is used by the great majority of hunters during the winter months. There are only a small number of men who use fur parkas of mouton or badger skin bought from fur dealers in the lower 48 states. These fur parkas are always worn with the hair inside and skin side out. Trim around the hood is almost always wolverine (Gulo gulo), which sheds frost easily and does not fill with snow when it is windy. A few cases were seen where caribou fur was used for the trim, and it is said to have the same qualities as wolverine except that it sheds more easily.

The fur parka is never worn without a cloth cover over it, which is called an atigiluk or kateganasi. This cover is simply a single layer of cloth which serves to protect the skin and sewing, and also can be used for concealment when hunting because it is usually white. There is little extra warmth derived from it. Occasionally the hood of the parka cover is made so that it can be drawn out over the wolverine-fur trim, protecting the face from blowing snow or concealing the dark fur from game which is being stalked.

Caribou-hide parkas are exceptionally warm and light, and do not require a great deal of clothing beneath them. Typically the Eskimo hunter prefers several light layers of clothing to one heavy one, and therefore several cloth shirts are usually worn. Some men wear a light nylon jacket or down-filled vest beneath the parka. The hood is always made to fit rather tight around the face so that the wind cannot blow into it, but a hat is almost always worn inside any parka.

The knit stocking cap is preferred by some men, while others use cloth hats with visors in front. Some of the knit caps are of a type which can be drawn down over the face, with a hole for the eyes, nose and mouth. A few men use knit ear bands rather than caps. The main interest appears to be protection of the forehead, which is not covered by the hood, and the ears, which are sometimes chilled by wind entering the hood.

Traditional Eskimo clothing, especially that used by groups to the east, included the use of both an inside and an outside parka. Rudiments of this are still seen in Wainwright, where several men use caribou-hide parkas with the hair turned outside worn over the inside fur parka. This double parka is actually too warm for most outdoor activities which are undertaken nowadays, so it is used only during severe weather or for fishing in extremely cold weather.

In earlier periods there were more activities which required a long patient wait, and generally more activity outside during cold weather.

Notable among these are hunting at seal breathing holes, seal netting and whaling. It was therefore necessary to use the warmest types of clothing. The Wainwright people mentioned also the former use of "undershirts" made from fawnskins, as well as pants worn with the fur turned inside. These are no longer used.

There is today some use of manufactured down parkas, but this is mostly reserved for warmer weather when fur clothing would cause overheating. For warm weather it is also an advantage to have a zipper in the front to facilitate cooling. During the spring of 1965 the men began using down and other cloth clothing as soon as temperatures were in the plus 10° to plus 30° range. There is also some use of muskrat, fox, badger, or caribou skin parkas with the fur outside, a cloth lining inside and a zipper in front. These are considered to be fancy parkas, made mostly for sale to visitors, and are only occasionally worn outside the village.

There is a very characteristic cloth parka which is made for use in the village or for summer hunting. This type has a cloth lining and a corduroy outside, with wolverine or wolf trim around the hood, wrists, and bottom. Typically there are cloth trimmings decorating these parkas, some showing considerable skill and ingenuity. When they are new these parkas are used only in the village and for social events, but as they become more worn they begin to be used for warm-weather hunting and other tasks which do not require the warmth of fur parkas. They are occasionally seen in use on the sea ice during winter, but this is the case only if the weather is exceptionally warm or if the individual does not have adequate clothing.

Birdskin parkas, which formerly were used along the Northwest Alaskan coast, are no longer existent today. The older men remember having used them and sometimes talk about having one made because they are so warm. In the region south of Point Hope cormorants were formerly killed and skinned in order to make long bulky parkas, which could be used with the feathers turned outside. Loon-skin parkas also were spoken of, made entirely from the neck skin and feathers of (probably) the common loon (Gavia immer). These parkas are said to be very warm and also waterproof. Some birdskin parkas were undoubtedly made to be worn with the feathers turned inside and with another parka outside, as is done in other parts of the Eskimo domain.

Outside the parka, especially if there is a wind, there is sometimes worn a rope or cloth belt called tafsi. This belt prevents wind from blowing up under the parka and heat from escaping downward, as well as affording a place to carry a hunting knife. The belt is sometimes trimmed with a "tail" of wolverine fur and is called pamiuktak, derived from the word for tail. Some men stated that this "tail" was formerly made longer and

could be pulled between the legs to protect the crotch from freezing in very cold weather. Belts were apparently used more in the past than in modern times, and nowadays they are much more in evidence at Point Hope, where they are sewed onto the cloth parka cover, than at Wainwright.

There is occasional use made of fur face protectors, usually consisting of the tail of a red fox (Vulpes fulva) or Arctic fox (Alopex lagopus), or of a long piece of caribou fur made into an elongated roll. This piece of fur is tied outside the parka hood and around in front of the chin and mouth. It will of course become frosty quite rapidly in cold weather, so it is turned around periodically, bringing dry fur in front of the face. Once the entire piece is filled with frost it must be thawed out and dried or else removed and replaced by a fresh one.

The only other face protection besides this, and the use of knit "stocking caps" which pull down around the face, is that provided by growing a mustache. As fall and winter approached in 1964 many of the men began to grow mustaches, which they kept at least until the spring warming trend. There are two reasons why this is done. First, because moisture from the breath will collect on the mustache hairs and be kept from contacting the skin of the upper lip. The writer can state from experience that it is more comfortable during extremely cold weather to have the mustache collecting frost than to have the exposed flesh chilled constantly. Second, according to the Eskimos, the fresh ice which forms on the mustache can be used for water, especially in an emergency situation. Indeed they were often observed to suck on the small beads of ice at the corners of the mustache while hunting or travelling.

Whether it is inherited or acquired, the fact remains that Eskimos show a hardy resistance to cold. One finds that their resistance is at first much greater than ones own, but that the differences become significantly less as time passes. One of the most convincing evidences of the fact that the Eskimos are fairly insensitive to cold is the fact that they seldom wear anything more than cloth "work" gloves, even in midwinter. To be sure they are often seen clapping their hands together or against their sides to warm them, but they will nonetheless stay out in minus 35° weather all day with only these light gloves on.

In cold weather such as this, and up to perhaps 0° F, most of the Wainwright hunters would wear two pairs of gloves. Rather than cause a tight fit by placing two identical pairs together, they would either mix brands, placing the largest on the outside, or very frequently turn the outer pair inside out which increases its internal dimensions. Thus two pairs of gloves can be worn without discomfort caused by a tight fit.

However certain individuals appear to prefer some heavier type of glove or mitten, and when it is very cold or they are on the trail many men will use more than just cotton gloves. Some men are able to obtain leather gloves with wool inserts, but these are not in common usage because they wear out too quickly and do not offer sufficient advantage over cloth gloves. However at least one man had five-fingered gloves made from summer-killed caribou, which has a very short but warm hair. These appeared to be very useful and warm but are perhaps so difficult to make that few people own them.

Mittens also are made from animal hide, and are of several types. The first is a typical mitten design with a thumb and no fingers. This type is easily made, even by the men, but is not popular because it is necessary to remove them to shoot. Caribou mittens usually are so warm that gloves are not worn inside of them; removing the mittens to shoot is out of the question in cold weather since the moist flesh of the hand would freeze instantly to the gun trigger. The second type of caribou mitten is called tikelak, derived from the work tikik which means index finger. These mittens have a thumb and index finger, with the other three fingers together in one space. These mittens are made from summer skins, and are excellent for hunting since it is possible to shoot without removing them.

There is another type of fur mitten, which is seen infrequently. This type has the fur outside, whereas the types above have the fur turned inside. Those with fur outside are made from caribou, seal, dog, wolf, or bear, and are designed with only a thumb and a hand space. Included with these we should mention the army surplus mittens which are available from mail-order dealers. Although these types are occasionally carried they are not used frequently, since the cloth gloves are usually sufficient.

Fur-outside mittens, which normally require gloves be worn inside, could be removed in order to shoot. However it is less advisable to remove the mittens to shoot than to simply go without. This is because the hands and gloves become warm and moist inside the mittens, and if suddenly exposed to the outside cold for several minutes the hands become very cold and even numbed to the point of uselessness. It is therefore wiser to wear gloves or mittens with fingers so that the hands are adjusted to the temperature at which they will be used.

Each type of fur has qualities which lend themselves to particular uses. This is taken into account whenever mittens are made. Seal and polar bear skin for example, are waterproof, and make the best mittens for use on the sea ice. However there are no polar bear mittens in use at the present time, and only one pair of sealskin mittens was seen at Wainwright.

There were several pairs of dogskin mittens, which are preferred to caribou because they are resistant to moisture and wear very well.

Mittens with very long fur outside are sometimes used for fox trapping, because they are the best for brushing snow over the trap set to conceal it. One such pair was made by Taqalaq from the skin of grizzly bear (Ursus arctos) one day while he was in his trapping camp. These mittens appear very large due to the long fur outside, and are in fact fairly large inside so that normally cloth gloves are worn with them. The fur is turned inside around the wrist.

These mittens are not only used for concealing the fox traps with snow, but have several other uses beyond keeping the hands warm. Most fur mittens are hung around the neck by a harness so that they can be removed without danger of losing them and can be kept available by leaving them hung on the harness and twisting them together behind the back to keep them out of the way. In the case of these bearskin mitts the harness was made long enough so that they could be placed on the ground beneath the wearer for a seat. This is especially useful on the young sea ice, where seal hunters often must sit down on the wet surface to shoot.

In addition these mittens can be used for improvised boots in case of emergency, such as drifting out on the sea ice and subsequently wearing holes in ones boots. The wrist flap is simply turned out so that the mittens become quite long, and then they fit over the feet with caribou "socks" on. Besides emergency uses the mittens can also be used for stalking caribou or polar bear when the snow makes noise underfoot. Taqalaq was also seen using these mittens to warm his face during cold weather.

The junction between the top of any kind of mitten or glove and the sleeve of the parka often is loose enough to expose the wrists to the cold air, especially when one is driving dog teams. In fact, frostbite on the wrists is almost as common as on the face among the Eskimos observed during the study. In order to prevent this, wristlets are made from fox, caribou, or other types of fur. These are simply a piece of skin folded in the middle so that the fur is outside on the top and bottom, and then sewed together at the ends to form a bracelet of fur. Wristlets are used only in very cold or stormy weather, when they are slipped on before putting on gloves or mittens.

Just as the aboriginal fur mittens have largely been abandoned in favor of cloth, so have fur pants given way to heavy cloth pants of various types. During pre-contact times either sea, bear or caribou skin pants were worn, sometimes with a caribou-fur liner inside. The use of fur pants, and other fur clothing as well, has diminished in spite of the great

advantage of wearing it. Perhaps most important is the fact that fur clothing, especially caribou, is much warmer than any manufactured types available to the Eskimo. This is particularly true in emergencies such as becoming lost or drifting out on the sea ice, where clothing may be the only heat source for many days. It is still the practice of some older men to carry extra fur clothing out on the sea ice in case they drift away.

Fur parkas are usually designed so that the wearer can pull his arms inside and then turn the sleeves inside out or plug them with mittens. The neck and bottom of the parka are tied closed with rope to further prevent heat loss. Caribou parkas and pants are also invaluable for sea ice use because of the buoyancy of caribou hide, which acts as a "life preserver" should the wearer fall through the ice. Caribou skins being carried on the dog sled or in a boat have also been used for this purpose. In addition, fur clothing is more waterproof than cloth and easier to remove water from in case of an emergency. This is especially true of sealskin sewed with sinew, which is very impervious to water.

In spite of these advantages, caribou-skin pants are only worn in the coldest weather and sealskin pants are used, by the few men who own them, only in late spring or summer on the wet ice. The most popular types of heavy pants in Wainwright are various kinds of army surplus pants with wool liners, Air Force flight pants, and down "insulated underwear" pants with cloth overalls outside. Again the preference is for several layers of clothing under the heavy cloth pants, but when fur pants are worn, only underwear or a pair of light cloth pants is worn underneath.

The writer owned a pair of heavy caribou pants while staying in Wainwright, but only wore them once before reverting to heavy cloth pants. There are two reasons for this: First the caribou pants proved to be too warm even for use in minus $30^{\circ}$ weather, and second because the leather restricts movement to a much greater degree than the heavier cloth types. In fact it is apparent that the Eskimo habit of bending over stiff legged, which is still present today, came about as a result of the confining skin pants.

The warmest type of cloth pants besides down are the blue flight pants. Many individuals in Wainwright owned these but often preferred other types because the flight pants are quite heavy and usually have a zipper down each leg which admits the cold. Those without zippers are coveted and frequently used, especially on the sea ice where it is damp, because they are fairly waterproof. Sealskin and bearskin pants, as well as other items of clothing, will be dealt with in the section on warm-weather gear.

Shelter

The second method of dealing with cold temperatures is by the provision of shelter. The concern of this report is to deal with temporary shelters, which are erected along the trail or at a camping spot which is away from the permanent village but is used throughout a particular season. These shelters are made with material available "on the spot", with items carried along on the dog sled or pack bag, or with a combination of both as is the usual practice.

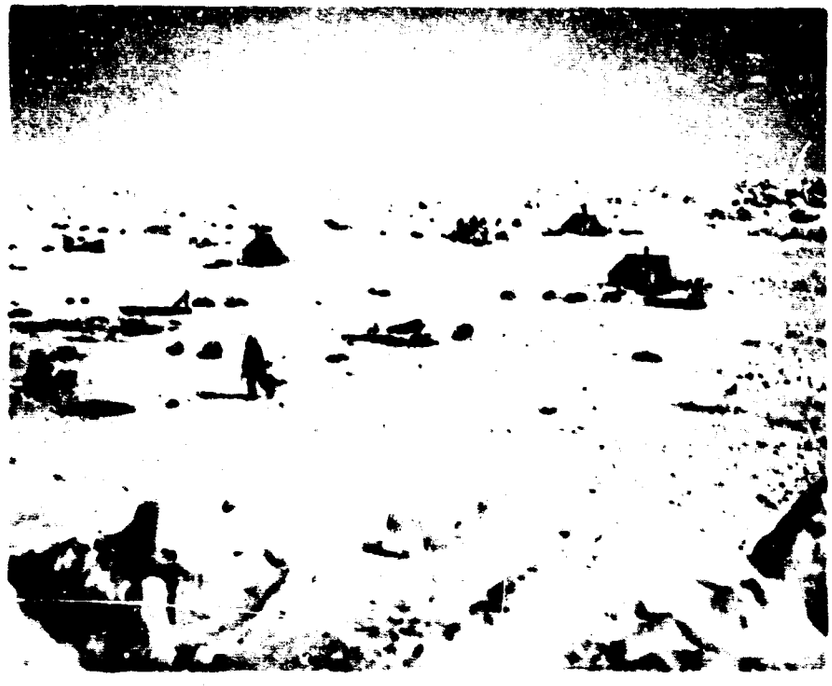
During the fall, through October and November, there are usually migrations of caribou moving north or south across the tundra some 20 to 50 miles inland from Wainwright. At this time also the snow begins to accumulate on the tundra and the huge Kuk lagoon freezes over solidly enough to permit rapid dog team travel. So the men load up their sleds with necessary gear and take off singly or in groups for caribou hunting trips which last for several days to a week.

At this time of year the temperature remains between plus 20° and minus 20° so there is no need for an elaborate shelter, and the small tents which are used will heat up quickly with camp stoves. Typically the camp is set up at a location where game was killed late in the day or where game is expected to be found the following morning. The tent is set up on some fairly level spot, with no great concern showed for the angularity of the subsurface because caribou-hide mattresses will be laid down inside.

While a man is travelling, the tent (tupik) is often used for a sled cover, being placed on the sled opened up while the gear is loaded, and then pulled up around and over the gear to protect it from the snow and from loss. The gear is therefore unloaded first and then the tent is erected. This is an easy job since the tent is only seven by seven feet square on the average, and the three poles needed for it are carried on the sled. The beam is placed up along the roof and the two end poles are fixed into the sockets at right angles. Along each side are four ropes, which are tied to the dog sled, dead caribou, heavy gear, or willow shrubs. The height of the tent is about four feet, with low walls about two feet high. Each wall has long flaps at the bottom which are folded inside beneath the caribou-skin mattresses and the tarp which is sometimes used under them. This prevents the wind from blowing the walls around, without the necessity of stakes or weights to hold them down. The door is a simple slit in one end which can be tied shut. These tents are made from canvas purchased at the native store, or may be bought ready-made. They are not waterproof.

For fall camping there is no use of snow blocks to protect the tent from wind, or of snow houses for greater warmth. Usually an extra canvas is

Several typical buildings at Wainwright, Alaska. Large drifts are formed by winter storms blowing through the village. The chain in the foreground is used as a line along which the dogs are tied.



A whaling camp several miles offshore near Point Hope. The tents contain seal oil-burning stoves to provide warmth, and gasoline stoves for cooking.

laid over the tent which allows for better heating and slower heat loss after the gasoline stove and lantern are turned off. Once this heat is turned off, the men, two to four in a tent, crawl into their sleeping bags. The sleeping bags used today are almost always down army surplus type used singly, and the men usually wear most of their clothing in them, removing only boots, parkas, and outer heavy pants. This is done mostly for the convenience of getting out quickly in the morning, or being prepared for any emergency such as a dog fight or appearance of game close to camp.

Similar tents, though somewhat larger, are used at Point Hope during whaling. These tents are set up out at the lead edge, one for each crew, and are used for cooking, resting, and sleeping. These tents are about 10 ft square and 6 ft high, and the floor has only a canvas over it, if it has that. The side ropes are anchored at each side with snow or ice blocks, and similar objects weight down the tent walls. There is no effort to protect the tent with snowblock walls, nor is there a tarp thrown over the top, so the tent is always rather chilly inside. Whaling camps are actually not designed for warmth and comfort, and the men do not use sleeping bags except as a sort of blanket. This is undoubtedly due to the fact that comforts such as tents and sleeping bags were formerly not allowed on the ice during whaling, and only during the present century have these prohibitions broken down.

In pre-contact times the tent (itchalik) was always used during late spring, summer, and fall. It consisted of a willow frame with caribou skin over it. This type is said to have been very warm and quite dry, since the hair was turned outside and the rain could not penetrate it. Sealskins were not used to cover the tents, according to Ikak.

The most important time for camping nowadays is the fox trapping season, which lasts through the coldest time of the year, from December 1 until April 15. During this time the men spend periods of 1 to 14 days at a time away from the village, usually staying at one "permanent" camp for the whole season. Since these camps are used a great deal, often by several men, every attempt is made to have them as comfortable and as warm as possible.

Some of the men set up trapping camps inside of wooden frame buildings or abandoned sod houses along the coast or inland. Many of these, such as the old shelter cabins along the coast, are in poor condition so it is necessary to use a tent inside them. This is still more substantial and roomier than snow shelters, and there is no problem with melting, so these wooden structures are preferred.

One man and his son used an abandoned sod iglu at the old village site of Atanik, on the coast about 20 miles northeast of Wainwright. This iglu had been the home of the man's father and was in excellent condition during the winter of 1964-1965. The internal dimensions of the house itself measured about 10 x 20 ft, with a roof about 5-1/2 ft high. The walls, built of logs placed vertically, slanted inward slightly, and the roof was slightly gabled; while the long (eight-foot) passageway was about four feet high and flat-roofed. The entire house was covered with sod and, during the winter, nearly buried by the snow.

Inside this structure a tent was pitched, just about filling the interior but leaving space around the edges for extra food, gear, and clothing. In this space the temperature remained below freezing, while inside the tent the camp stove kept the temperature in the 60's or 70's. Arranged inside the tent were the caribou skins and around the edges the camp stove, "grub box", dog food container, and miscellaneous gear. At one end the clothing was piled, to be used for a pillow at night or a back rest for sitting.

These two men carried one sleeping bag between them, but did not use it. Rather they slept with light jackets on or over them, leaving all of their clothing on, and burning the camp stove at night. This was done because outside of the house they had piled their dog food, which in this particular area might easily attract a polar bear. If the dogs were heard barking the men would run out quickly, grabbing one of the rifles left in the passageway, in case the dogs had seen a polar bear.

Tagazook set up his trapping camp, along with two older men, at a spot 20 miles inland from Wainwright. Since there are no buildings or old iglus at the spot, they constructed a killegun, which is a square snow-block shelter with a canvas roof inside of which a tent is pitched. The killegun is built by first constructing four snow-block walls around the square hole from which the blocks are taken. The blocks are cut out with an ordinary hand saw and removed with a shovel. This leaves a hole about 2-1/2 to 3 ft deep, surrounded by a wall made from several tiers of blocks, about 3 ft high, for an internal dimension of 6 feet. The floor size is about 8 x 10 ft, leaving some extra room around the 7 x 7 ft tent.

Between the tops of the end walls is laid a pole supporting the gabled canvas roof, which is weighted down around the edges by blocks of snow and on the top by caribou skins and various items for hunting and trapping. The entry is at one end, made simply by cutting a step down to the floor level from the outside and then making a small opening. Outside of this opening an extra canvas-covered "hallway" was made during one storm, so that the door was at right angles to the wind rather than facing into it.

The tent was pitched inside of this shelter after all of the spaces in the outside walls were chinked with snow. The side ropes of the tent were tied to stakes put into the snow walls. Around the space in front of the tent some items such as dog food, gasoline, and extra food were placed, much the same as was done in the other camp described. Inside of the tent were several "grub boxes", the camp stove, clothing, and of course the caribou-skin mattresses. This mattress is one of the essentials for all camping among the Eskimos, and they seldom travel without one on the sled to use in case of emergency and to pad whatever gear is carried. Mattresses are excellent insulation when placed beneath the sleeping bag, and one skin, placed hair side up, is all that is needed for each camp.

As mentioned previously most Eskimos own down sleeping bags of various types, and they normally are used during camping. Formerly the sleeping bag was made from caribou skin, and this was replaced by reindeer skin during the period of reindeer herding on the northwest Alaskan coast. Reindeer is said to be preferable because the hair is thicker. Skin sleeping bags were made simply by sewing two skins together and, although they were warmer than the down used today, they were very bulky.

Sleeping bags were used in the camp described above, but during the waking hours the tent was heated to an uncomfortably high temperature by the camp stove and gasoline lantern. With the outside temperature a very stormy minus 18° F, the temperature inside the tent was plus 105° four feet from the floor and plus 85° two feet above the floor. The efficiency of snow dwellings was certainly proven by this experience, and it is little wonder that in all winter camping the killegun is used if no wooden structure is available.

The "typical" Eskimo snowhouse, made in a hemispherical or conical shape, was not used in the western portion of northwest Alaska, although it was sometimes used along the areas close to Demarcation Point. Old man Ikak had lived in them as a boy near Herschel Island, but stated that they were not used very much. Preference was given in all of northwest Alaska to the killegun or to the aneguchak which was simply a square snowhouse as described above but with a gabled snow roof.

This type was not seen in use during 1964-1965, but is described by Brower (14) as a rectangular snow-block house with the entrance in the middle and sleeping areas at either end. The small space between the sleeping areas was reserved for the stove lamp, which supplied heat and light. In this type the blocks of snow also were taken from the hole and set up around it, but were slanted somewhat inward. The top blocks were set on the walls, meeting in the middle to form a gabled roof. Snow was shoveled over the entire house and then the door was cut down to the level of the

bottom. The door was closed with a snow-block in this case, but in a similar house described by a Wainwright Eskimo, the sunken door (kattaḳ) was covered with a grizzly bear or caribou skin.

Such an elaborate snow shelter as this would not be made for emergency use, such as drifting away on the ice or becoming lost in a storm. In this case a more simple one-man shelter might be made of snow-blocks. The Eskimos apparently feel that it is best to sit rather than to lie down, at least if there is no sleeping bag available. One old Point Hope man said that it is "bad luck" to lie down to sleep if you are ever lost out on the ice.

An emergency camp described by Taḳalaḳ consists of a hole dug into the snow just large enough for a man to sit in. Blocks of snow are placed around it to form a good shelter and the "snowshirt" or outside cloth parka cover is placed over the door opening. Once a man is inside, the mittens are placed on the seat to prevent heat loss and melting the snow, and the arms are pulled inside of the parka and folded across the chest.

Kusiḳ was once out on the tundra alone and became lost in a heavy fog. He built a snow-block shelter with a roof and a bench of snow inside. On top of the seat he made a cushion of reindeer moss and sat down on it. He sat in that shelter, which was open but had the open side facing downwind, for four days. Each day he would get up and walk around a little, trying to find a landmark, and then he would trace his own trail back to the shelter. He had no food and the only water was that which he made by melting snow in a tin can held against his body. This story illustrates several principles besides how to build an emergency shelter, such as the rule of camping whenever one becomes lost, and of melting water rather than eating snow. These will be dealt with in detail later.

It is worth noting here that Eskimos are always very careful not to sit directly on cold surfaces such as snow or ice, because of the danger of heat loss and of dampening the clothing. They always place something between their body and the subsurface. It might be suggested for such emergency shelters that a cloth or pad of some sort be placed under the feet as well, such as is done for the long and cold waits at seal breathing holes.

It is of course essential to do so also when a sleeping bag is used, and the universal practice of northwest Alaskans is to use a caribou skin. In an emergency one may be caught without any sleeping bag whatever, but killing a polar bear or a large caribou could provide a skin with which to improvise a sleeping bag. In this case one must be careful to lay the skin beneath as well as over the top of the body, and in so doing not to place the ends of the skin under one's body. Fresh skin will freeze solid during the

night, and although it still retains the body heat of a man inside it, it will also trap him securely inside unless the opening is on the side or top where it is possible to force it apart. One man said the he was almost imprisoned inside of a caribou skin this way.

The use of a sleeping bag alone should, of course, never be necessary in the Arctic winter, because normally there will be plenty of snow to build at least a windbreak. One instance was recorded where a man and his wife chased a "coyote" for three days before finally killing it. At night they stopped their dogs and slept on the sled, covering themselves with the sled canvas because they had no sleeping bags. Such cases as this are unusual because few situations arise where such discomfort would have to be endured. It was not explained by the informant why he was so persistent about getting the animal.

## Fire

Closely related to shelters is the provision of heat from fires, the third method of dealing with cold temperatures. The tundra does not provide a source of wood along the coastal region of northwest Alaska, although there are some quantities that wash up along the shore during the open-water months. This wood is too valuable for burning to provide heat, however, and there have always been better fuel resources available to these people. Only once did this writer see wood used for heat outside of the village, and in this case it was in the form of a huge bonfire lighted to heat the spectators at a Wainwright village dog race.

Some use of wood for heat is made by the Wainwright and Point Hope people, but this is normally only for kindling the coal at Wainwright or adding to the seal-oil-burning stoves at Point Hope. The Wainwright people for the most part utilize the native coal for their home heating, although a few do use fuel oil bought from the store. The Point Hopers are not nearly so fortunate and depend heavily upon seal blubber, or else on coal or fuel oil purchased at the store.

During the whaling season at Point Hope most of the tents had blubber-burning stoves. These stoves varied somewhat, but mostly were a home-made metal "box" divided into a burning compartment and a baking compartment and placed up on some sort of metal legs. To burn the seal oil, chunks of raw blubber (mitaḥinagak) which are kept frozen outside the tent (to prevent loss of the oil) are thrown into the stove "as is". In the village there are usually chunks of wood or coal placed inside first, but nothing except blubber is used out on the ice. Once lit, the blubber burns rapidly, with a characteristic sputtering and an even more characteristic black

smelly smoke. Most of this smoke leaves the tent through the stovepipe, and the warmth of the stove heats the tent cleanly. Seal-oil stoves were not used much for cooking in the whale camps, although they are used for this purpose in the homes at Point Hope.

The characteristic Eskimo stove lamp is well-known and since it is no longer in use in this region it will not be discussed in detail here. However, certain applications of the principles of these oil lamps are important to Eskimo survival practices today, and should be considered. In aboriginal times each house and camp was equipped with a stove lamp, called a tuuaniktak or nanik. This consisted of a shallow bowl in which rendered-out seal oil (ohuzok) was contained. At one edge or at the middle there was a wick, made from crushed moss, crumbled decayed wood, pussy willow fuzz, ivory shavings, or other fine material. This wick soaked up the seal oil and when lit and trimmed properly would give off a soft light and sufficient heat for warming the house or boiling water.

These lamps disappeared with early contact with whalers and "outsiders", but the knowledge of their use is carried on by the hunters, since an improvised nanik would provide heat and light for drift ice survivors, and would be easily made even by the most unpracticed young man. One of these lamps which was made as a demonstration showed that only four elementary materials are needed:

1) A container--preferably flat and saucer-like, but anything from a tin cup to a piece of aluminum foil would work.

2) A wick--can be made from cloth, rope, sawdust, crushed-up tobacco, etc.

3) Seal oil (or perhaps other types of oil, even peanut butter).

4) Something with which to light the fire.

An example of this type of lamp was made from a jar cover and a small piece of cloth. The cover was filled with seal oil and the cloth was laid flat in the oil, with one end turned up along the lip of the cover. This exposed edge was lit and slowly began to burn with a quiet yellow flame. This flame is controlled by simply moving the wick higher or lower, exactly the same as is done with the wick of a kerosene lamp, but here it is even more critical that the flame be kept low due to the heavy black soot which comes from even the slightest bit of smoke.

These lamps have a fairly hot and bright flame, such that a good-sized lamp could be used for making water from snow and for cooking. They are also very simple to make, being in principle virtually identical to the kerosene lamp. They are also easily supplied with oil, since just one seal provides from 10 to 100 pounds of blubber. However, aside from these good qualities they are difficult to light initially, especially since the gentle flame is so easily affected by air movement. It is also difficult to keep the wick burning at the proper level to avoid the heavy smoke; and even if this is done correctly there is always a strong odor given off by the burning oil.

Another type of improvised lamp demonstrated by an Eskimo, was made from a tin can. The topless can was first filled part way with oil, and then a piece of heavy cardboard measuring four inches square was fashioned into a device to hold the cloth wick. The cardboard was folded in half and placed over the can by cutting slits which would slide down over the edges and hold firmly, so that the cardboard was V-shaped, with the open side down. The wick was slipped up between the cardboard, and a slit along the fold enabled the wick to protrude slightly, as the wick in a kerosene lamp sticks out through a thin metal slot. In this case the wick was raised or lowered by a sharp object or the fingers, stuck through two holes in the sides of the cardboard. This type of lamp could be made in many ways, perhaps best by punching a slit in the cover of a can or jar and pulling the wick up through it.

In emergency situations seal oil cannot be made in the normal way, which involves placing strips of blubber in a jar or can, or inside of a sealskin pok, and allowing the oil to render out slowly. There are two methods for making seal oil rapidly: fire and pounding. The Point Hope people use the fire method when they burn blubber in their stoves, but in aboriginal times it was done in a different manner. A piece of blubber was hung over the stove lamp so that the flame would heat it, which caused the oil to drip from the blubber into the lamp. The lamp would become self-regulating if set up by an experienced person, because the dripping oil would raise the level of the oil enough to decrease the flame, which in turn slowed the speed of trying out the oil. As the oil in the lamp was used and the level dropped, the wick burned brighter, again causing more oil to drip into the lamp (11).

Oil can also be made by pounding blubber with a hammer of some sort. This type of oil is called kaavaksinek. To the camper or sea ice traveller this method would probably be the most convenient, as long as he has something in which to pound and collect the oil.

Because of the importance of fire for the provision of warmth in the Arctic, the Eskimos are very careful to carry matches wherever they travel.

This is especially true on the sea ice, where the hunter may not require matches unless he is caught on drift ice, but in this case he would depend very heavily upon them in order to burn seal blubber. Under survival conditions, matches are split lengthwise in order to make them last longer. Eskimos are more prone to carry wooden matches than paper ones. This may be due to the fact that wood matches light anywhere (the Eskimos seem always to light them with a thumb nail) and they also burn better and longer in the wind. Some of the Eskimos also have cigarette lighters.

The only other method of lighting fires which was seen demonstrated was that of striking metal against stone to create a spark. In this case the stone was an old artifact made from a cherty substance, and the striker was an old iron file. On top of the stone, right at the edge, was held a dime-sized piece of willow fuzz which had been rubbed in soot. The file was held vertically so that the edge could be briskly struck against the stone and the resulting sparks would shoot into the fuzz. If done properly the sparks eventually ignite it, and the glowing fibers can be used to light a larger flame. The old techniques of fire making, such as this one or the use of fire drills, have been forgotten by all except the older men, and even they have seldom been without matches.

In modern times there has also been little need for the seal-oil lamp for heat and light because of the introduction of efficient gasoline stoves and lanterns. Kerosene lamps and Primus stoves were undoubtedly owned by Eskimos along this coast from the time of the first whalers. Although still used today by some individuals, these have mostly disappeared in favor of pressure-gas, Coleman stoves and lanterns. Only within the last 10 years or so have privately-owned electric generators supplied power to some households in Wainwright, and in Point Hope a village generator plant became operative. Of course this is not important for camping and traveling, where the gas-burning stoves and lights are used.

Every hunter owns a camp stove (siohozuk) and many of them own two, three, or even four (15). The stoves are carried by at least one man in every hunting party, even if the trip is expected to last only a day and no camping is involved. There are two reasons why the stove and plenty of gas are carried: First, the Eskimos never go for more than a few hours without a tea break. Sometimes a thermos bottle is carried, but more often the tea is brewed on the spot with the camp stove. Second, it is usually taken along in case of emergency, such as a storm which would necessitate stopping on the trail or drifting away on the sea ice.

The Coleman stoves used are two-burner types, fairly bulky but easily carried on the dog sled. A gasoline can is carried for all trips longer than one day, containing two to five gallons. White gas is bought from the native

store, and is undoubtedly one of the largest expenses for most families. The single-mantle Coleman gas lantern is also carried with the sled load for all winter camping, but is somewhat more difficult to carry because it is more fragile. Extra mantles are always required for each trip, since they almost always break on the rough trail. Many men do not replace the glass globe once it has been broken, wrapping the lamp in cardboard whenever it is carried on the trail.

These gas lanterns are heavily depended upon nowadays, and candles are almost never used. One man was forced to return to Wainwright from his trapping camp because his gas lamp was malfunctioning. He said that he had candles along, but did not care to get along without bright light inside and a light for working outside, since this was during the darkest part of the winter. The gas lantern gives off a very bright light and is sometimes left outside near the tent so that a passerby can locate the camp if it is dark. Inside a well-built camp the lanterns throw off a surprisingly large amount of heat, and often are left on all night to supply warmth for the tent.

The main provider of heat for Eskimo camps is the gasoline stove. It is for this, more than for cooking food, that the stove is carried. Since much of the meat is eaten raw, the main cooking function of the stove is heating water for tea or coffee. As soon as any camp is set up, the stove is lighted immediately and the men crawl inside the shelter to enjoy the warmth. If there is work to be done outside such as skinning game or feeding the dogs, they will leave the stove burning, probably with water on top for tea, so that it will be warm for their return. Tents may be set up along the trail for a tea break if it is stormy, or out on the ice in the afternoon, so that the men can crawl inside, remove their parkas, and warm up.

These breaks and warm camps appear to help the hunter, who must remain outside for so many hours each day, to resist the cold more easily, psychologically if not physiologically. This is why the houses and camps are heated to high temperatures, and why so much effort is made to provide comfort for even the shortest tea break.

## Food

The fourth method which the Eskimos have for providing warmth is the use of food. According to the Eskimo hunters, food, especially certain types, will help to maintain bodily warmth during routine hunting and travelling or under emergency conditions. It is believed that only Eskimo foods called nekepiak (neke= "meat", piak= "real") will really be helpful for this purpose, and particular types are the best. Most preferred by the

Wainwright people is ḳwawḳ or frozen meat, especially caribou, eaten with seal oil (ohozuḳ).

The idea that meat with fat or oil will warm the body is very strongly held, and this is a common food on the trail or in camp. Other meats eaten raw are frozen fish, walrus, and seal, the latter two being rather uncommonly observed. Fat or oil is not normally eaten alone, but meat is dipped into it or else small chunks are sliced off with a knife and placed between pieces of meat. Oil is only eaten or drunk as a cure for sickness, such as stomach ailment, or in case of food deprivation. In the latter case a piece of fat is placed on a stick and held over the heat of a fire, and as the oil comes out from the fat it is licked off.

Consistent with the idea that raw meat and blubber is an aid to maintaining body warmth, the food for dogs is adjusted according to the weather. In warm periods the dogs are likely to be fed any of a variety of foods, but when the temperature drops far below zero and the wind blows, the dogs are fed only what is considered to be the best food available. Usually this is walrus hide with the heavy layer of blubber attached, which is called ḳauḳ. This must be thawed during cold weather both for the sake of providing even more warmth for the dogs--so that they will not have to thaw the food in their stomach and mouth--and in order to soften it enough so that it can be chewed.

Seal blubber may be given to the dogs, cut into long strips (three to four inches), and is said to be the best food for keeping dogs warm through the long winter nights. This is not done if the dogs will be used much the following day, however, because they will run slowly or even become sick. Seal meat with some blubber attached makes an excellent food for cold weather, supplying warmth and energy even though small amounts are used.

The tendency is to feed the dogs plenty of food, up to four and five pounds per dog each day, if the weather is extremely severe. The dogs must of course lie outside on the snow in all weather, and during years when food is low, dogs will freeze to death due to insufficient feeding. Perhaps it is also true that people eat more during outdoor activities in cold weather. There are few overweight Eskimo men, but nevertheless, they do appear to consume a great deal of food.

The daily fare in Wainwright households is somewhat varied, but tends heavily toward caribou meat as a main staple, or at least this was true during 1964-65 when the caribou had been plentiful. In the home, caribou meat is eaten raw a great deal, but is not infrequently cooked. In cooking it is usually boiled and made into "soup", or sometimes it is broiled. Fish are almost always eaten raw and frozen, with seal oil, but are occasionally

boiled. Another favorite food is duck "soup" made by boiling duck meat, rice, and flour. Often the main dish is eaten first, followed by tea and coffee served with biscuits or bread slices. Bread consitutues no small proportion of the diet of these Eskimos, and is often eaten with butter.

Seal meat is not important at Wainwright except for dog food, but at Point Hope it must be a large element in the diet. By the same token whale meat is very important at Point Hope but seldom is seen at Wainwright, where whales are rarely killed. In both places walrus meat is apparently not favored and polar bear is spoken of enthusiastically, though not commonly eaten due to the decrease of polar bears in recent years.

In camps there are two common methods of food preparation: Either it is boiled or it is eaten raw. At Wainwright caribou was the staple camp meat, and was much preferred if it was fresh. When caribou are killed the tongues and hearts are removed and as soon as a camp is set up these are boiled together for about one-quarter to one-half hour in a large pot. Tongues are considered the greatest delicacy from the caribou and are boiled without cutting them up, unlike hearts which are cut into strips. Once cooked they are pulled from the pot on the end of a knife and each man cuts off slices from his own piece, dips them in seal oil, and eats them with relish. At the same time the strips of heart are eaten.

If there is no chance to eat caribou immediately after it is killed, such as when it is carried out onto the sea ice, it is not cooked. Fish are convenient to carry and were seen several times being carried on the sea ice. In the latter case it may have been done as an emergency supply in case of drift-away. Walrus kauk is carried for dog food on trips of over one day's duration, and seldom is included in the camp diet.

Tea, coffee, bread, butter, and jelly are the important camp foods besides meat. At every stop and many times each day in camp, tea is prepared and bread is eaten in large quantities. In fact this may be the staple for several days at a time, as long as the bread holds out. The term "bread" includes homemade bread, biscuits (baking powder, sourdough, or bread), or "pilot bread". These various types of bread are usually thrown together into a small flour sack and eaten frozen along the trail or thawed out after reaching camp.

In the morning coffee is usually prepared first, and tea is later made to fill the thermos jug if one is to be carried. Inconsistent with the idea that good meals will stimulate warmth, the morning meal is light when in camp, usually consisting only of coffee and a little bread. In fact it was frequently stated that the fathers of the older men only drank water in the morning and did not eat until they camped. This was done because "eating makes you

hungry". But it was also said that if they did eat at all they always had raw meat, because it stayed with them the best. To some extent this is still practiced, and the men say that cigarettes help to dull their hunger. Virtually all of them smoke, with the exception of a few who have recovered from tuberculosis or whose religious beliefs prohibit smoking.

As previously mentioned, frequent stops are made along the trail or during the day's hunting activities, when the men rest and drink tea. If a stove is not carried or is not used, the men drink from large thermos bottles, called unaqtuukagavik, which are available at the native store. Usually they are carried inside of a case made of caribou hide, which is called an unaqtuukagavium puna. This consists of a long cylindrical container which is closed at one end by a piece of cloth with drawstrings inside of it.

## Activity

A fifth method of providing warmth is by physical activity or self-exertion. Several Eskimos told of being caught out in a storm when improperly dressed or of falling through young ice and soaking the clothing. In most cases these men were close to the village and headed for home, and they said that in order to keep warm they had to run alongside their dog sled. It is fairly common in fact to see men run for brief periods while they are travelling by dog team, because in very cold weather the body chills quickly.

Seal hunting often requires a long wait along the edge of the open lead, which causes the hands and feet to become cold rather quickly. Often the hunter will stamp his feet or do an "Eskimo dance" while he watches out over the ice. And even more commonly men are seen clapping their hands together or against their sides. During mid-winter several young men became chilled while awaiting the finish of a two-hour-long dog race, and in order to warm up they played several jumping games.

These activities were, however, all conducted close to the village, where there was no real danger of overexertion and it was of little consequence if the clothing was dampened by perspiration. It is worth noting that in any survival situation care must be taken to avoid this, because perspiration will rob the clothing of some of its insulating qualities. If an Eskimo is forced to remain outside without a shelter or a sleeping bag, he will find a sheltered spot and then sit it out, sleeping as much as possible and walking around in order to restore warmth as often as he becomes chilled. This is considered to be safer than groping through a storm or travelling when directions are lost, which only amounts to a senseless waste of energy.

## Protecting Exposed Flesh

During travel in extremely cold weather the greatest problem of maintaining bodily warmth is on the exposed surfaces of the face. During the winter of 1964-65 several men were frostbitten over fairly large areas of their cheeks, noses, and chins. Small nips, resulting in blisters or sores on these areas, were fairly commonly seen, especially on certain individuals who appeared to be more susceptible. Several men in Wainwright were said to be more easily chilled by the cold than the others, but no mention of tendency to become frostbitten was made.

It is especially difficult to protect the face from a cold breeze when a man is on foot, because it is not possible to turn the face away from the wind when walking against it. Driving a dog sled is much more comfortable because the rider simply turns his face to the side or stands sideways on the sled to escape the wind. Occasionally Eskimo men become frostbitten while chasing game such as caribou with a dog team, because it is necessary for them to watch the trail ahead and their hands are occupied with setting the snow hook and holding the rifle.

It is typical for the Eskimos to warm the face with their hands, pulling one hand out of its mitten or glove and holding it briefly over the cold parts. Usually it is possible to sense a sharp stinging sensation in the flesh before it becomes cold enough to become frostbitten. When this happens a warm hand is quickly placed over the chilled flesh. Hunting partners will watch each others faces if the weather is cold, and if white spots appear in the flesh a warning is gi n by the other man.

No Eskimo was ever seen to warm his hands or face with his warm breath. Inexperienced persons tend to believe that breathing into a cold glove to warm the inside or onto a part of the clothing while holding it against the face will satisfactorily warm the flesh. At moderate temperatures, perhaps zero or above, this may not cause harm, but when the temperature is low the vapor from the breath does more to chill the flesh than to warm it.

Occasionally a fur mitten or the parka ruff will be held over the face to protect it from chill and to rewarm the flesh. It was once stated that it is sometimes not harmful to breathe through the nose into caribou fur, but not through the mouth or into cloth and poor types of fur. However, absolute safety is insured by using the bare hand. The brief period that the hand is exposed for rewarming is not enough to endanger the hand itself, and when caribou mittens are used there is little heat loss inside so that the hand is immediately rewarmed.

A favorite method of preventing frostbite, which is frequently used when the face becomes very chilled, is wiping mucus from the nose over the affected areas. This method may seem to be of rather doubtful validity, but it hardly seems possible that a pragmatic people such as the Eskimo could be mistaken about something so important and ever-present in their daily life. The method was observed to be used on various occasions, certainly without ill effect to the individuals who did so. It was reported also that a white man who was resident in the village of Wainwright for several years often used the technique, because he was very susceptible to frostbite.

Considering the amount of time spent outside in severe weather, the Eskimos have remarkably little difficulty with freezing or frostbite. The hands are evidently frostbitten very seldom. When chilled, they are held inside the parka hood, pulled inside through the sleeves, held against the flesh of the lower abdomen, or the fingers may be placed inside the mouth if they become very cold. Eskimo footgear is so effective as protection from the cold that cases of freezing must be almost nonexistent. During the winter of 1964-65 the only case of freezing of the feet was that of a white man who was wearing military-issued rubber footgear, while a companion wearing native boots felt little discomfort.

Should the feet become very cold, the Eskimo remedy is to hold them against someone's bare stomach, and this method is also used to thaw feet which have become frozen (14). When blisters form on frostbitten skin they are left alone as long as the individual is not at home, but upon returning he will puncture them at the edges and drain them. Brower mentions a case when he froze his heels and could not walk, so an Eskimo fashioned for him a pair of "sandals" which were cut in such a way as to prevent his heels from touching the ground when he walked. He reports that they worked very well (14). During the study no reports were heard of adults having frozen themselves seriously, although adolescents and children have become lost and frozen to death.

## Effects of Warm Temperature

During the cold winter months conditions for travel and hunting are ideal because the snow is dry and hard, creating the most favorable conditions for dog sledding and for foot travel. The months from December to April are nearly free from thaw, and in fact the temperature seldom climbs above zero. Warm spells are not considered a blessing at this time of year because the snow softens and becomes sticky, creating poor conditions for dog mushing, and the dogs themselves tire quickly from the heat. In addition, the wetness permeates everything and later freezes solid.

By the end of April the daytime temperatures are always above zero, and thawing takes place even if the temperature does not exceed the freezing point. In May the thaw has really begun, although the monthly average temperature in northwest Alaska is not above freezing until June. The warm temperatures are welcomed, even though they cause many problems for travel and for keeping dry. There is little danger from the cold, so the wetness matters less, but there are special types of clothing used for these slushy conditions.

The largest problem during the spring thaw is keeping the feet dry and comfortable. This is less true on the land, where the snow vanishes quickly, than on the sea ice where the snow lies in deep slushy drifts. The snow thaws and creates large puddles, and the ice itself helps to chill damp feet. In order to cope with this the aboriginal Eskimos used sealskin boots which were soaked in urine, had the hair scraped off, and were sewed and oiled to make them waterproof.

Murdock (6) described the waterproof boots of the Barrow Eskimos in the late 19th century: Waterproof boot soles are made from the oil-dressed skins of white whale, bearded seal, walrus, or polar bear. The last material is not usually mentioned as being used for sole leather among the Eskimo. It is considered an excellent material for soles at Point Barrow.

Sealskin boots seen in use at Point Hope appear to have uguruk skin soles. The other materials are no longer used for this purpose. The boot soles are likely to be the first part to wear through, especially if the wearer is forced to walk many miles over the ice, as he would if he should drift away on the ice. In this case there are several methods of providing emergency repair. Skin boots offer the advantage that they can be put on with the foot inside the leg portion, with the foot turned backwards underneath and tied, so that if there are holes in the bottom the moisture and snow will not contact the wearer. It is frequently mentioned that pieces of sealskin or bearskin can be tied or simply frozen around the outside of the boot sole, giving warmth and extra protection. Bearskin with the fur outside was tied to the bottoms of the boots for silent stalking of game in former years. Sealskin is used with the fur inside for emergency boot soles.

When skin boots, or any type of clothing, become damp they are very carefully dried each night. Often there are lines strung along the ceiling of the house from which every damp article is hung to dry, regardless of the season. This is something which non-natives tend to neglect, whereas the Eskimos are aware of the additional safety and confort of dry clothing as well as the fact that skin clothing rots quickly if it is not kept dry. If

gloves or socks become very damp while a person is travelling they can be dried by tucking them inside of the belt or the shirt to dry against one's own warm skin.

At Wainwright there were apparently few pairs of sealskin boots in use, preference being given to manufactured rubber footgear during warm and wet periods. The Point Hope people make much greater use of boots, but also use rubber types when the weather is quite warm. One advantage of rubber boots is that there are treads to prevent slipping on the rough and wet sea ice. Skin soles can be equipped with a rather simple tread, which consists simply of strips of bearded sealskin about one-half inch wide by three inches long, sewed at the toe and heel of each boot. Similar treads are described by Murdock (6) for the Barrow Eskimos, except that these treads were folded pieces bent into a half-moon shape.

Several persons described hip-high sealskin boots which required two ringed sealskins to make. These boots were used for hunting in the late spring where there are deep puddles on the sea ice and when seals are hunted by crawling across the wet ice. In lieu of these, short sealskin boots and sealskin pants were worn. In aboriginal times parkas and mittens were also made from waterproof sealskin for spring use.

Except for the skin boots, spring and summer clothing of the contemporary Eskimos of this region is largely made of cloth. Nylon or down manufactured parkas and homemade "summer" type parkas are used in all but the chilliest weather. Cloth pants, gloves, and hats are also the rule. An important element of the spring gear is sunglasses, which are necessary to prevent discomfort and snow blindness as soon as the March sun glares brightly off the snow.

The aboriginal Eskimos used "sunglasses" which were made in two ways: One consisted of a narrow wooden piece which fitted over the eyes and had either one slit, two slits, or two holes carved into it; the other was made from two caribou hooves fastened together in the middle and tied around the head. These "sunglasses" had the distinct advantage that they did not fog or frost as do modern sunglasses, but they also restricted the field of vision. Sunglasses, which are now bought from the store, are necessary for most individuals by March 10, but there is considerable variation in how regularly each person uses them. Early in the spring the cold temperatures often render them uselss due to frost, and the drizzle and fog later on may do the same. At Point Hope during whaling there were a fairly large number of men who did not use sunglasses constantly, which was a noticeable difference from Wainwright where they were universally employed. There are many other effects of the spring sunshine and warmth, but these will be dealt with under other sections.

The Eskimo must, therefore, modify his activities according to the variations in temperature. It has been shown that cold is permissive in that it provides for ideal conditions of snow-travel. There are subsidiary correlations to these permissive aspects of cold temperature, which were dealt with above. In addition there are the important prohibitive effects of cold, and another series of correlates.

The man who wishes to hunt or travel must alter his activities and equipment according to the temperature, especially when it falls to extremely cold levels. When it is very cold he is, first, forced to add layers of clothing or to wear his warmest items. It is of greatest importance, also, to carry additional clothing in case of emergency. The inventory of equipment is also altered to include items such as caribou mattresses and gasoline stoves, which provide against deprivation in extreme weather conditions. Extreme cold decreases the mobility of Eskimos not only because of the bulk of the clothing, but also due to the necessity of avoiding exertion which could cause perspiration or lung irritation. And, finally, cold weather activities require increased alertness and sensitivity to the surroundings so that the Eskimo can anticipate changes in weather or ice conditions most accurately. During such periods, unnecessary outdoor activities are avoided in order to minimize risks and to reserve them for favorable weather, when operations are most efficient.

## III

## WIND

### Wind Speed and Storm Frequency

More than anything else the wind dictates the activities of Eskimos in northwest Alaska. During the summer the ice pack moves in or out according to the wind, moving with it the herds of walrus and bearded seal which are so important to the economy of the northern villages of this region. During the fall powerful storms determine when the ice hunting shall begin and whether or not the hunters can travel out hunting the migrating caribou herds. In the cold winter, storms or even brisk breezes shut the villagers up inside their houses or in their camps. These storms of the darkest months can open wide leads, providing abundant harvest of seals, or close the ice so that even the polar bears want for food. And in the spring the wind is watched closely because upon it depends the success of the whaling season and the time of the annual breakup.

The winds of the Arctic are therefore the friend and the enemy of the Eskimo, depending upon their occurrence, direction and strength. At

## TABLE II

### Storm Periods at Wainwright, Alaska 1964-65

| Month | Date | Duration (Days) |
|---|---|---|
| November | 12 - 17 | 6 |
| | 19 | 1 |
| | 23 | 1 |
| December | 14 - 16 | 3 |
| | 18 | 1 |
| | 20 - 21 | 2 |
| | 24 - 27 | 2 |
| | 26 | 1 |
| | 29 | 1 |
| January | 1 - 6 | 6 |
| | 9 | 1 |
| | 18 - 27 | 6 |
| | 25 | 1 |
| | 27 | 1 |
| | 29 - 30 | 2 |
| February | 1 | 1 |
| | 3 | 1 |
| | 11 - 12 | 2 |
| | 15 - 16 | 2 |
| March | 4 - 7 | 4 |
| | 9 - 10 | 2 |
| | 16 - 17 | 2 |
| | 20 - 22 | 3 |
| | 24 - 26 | 3 |
| | 29 - 31 | 3 |
| | | 58 |

Barrow a maximum wind speed of 100 mph was recorded in January. "Winds of 50 to 60 mph along this coastal area are not uncommon; and wind speeds of better than 70 mph have been experienced in February, March, and November at Barter Island with an extreme speed of 86 mph recorded in February."(12).

TABLE I

Wind Speed and Direction at Barrow, Alaska (12)

| Month | Mean Hourly Speed | Direction |
|---|---|---|
| Jan. | 11.0 | ESE |
| Feb. | 11.3 | ENE |
| March | 10.9 | NE |
| April | 11.5 | E |
| May | 11.8 | NE |
| June | 11.4 | E |
| July | 11.8 | SW |
| Aug. | 12.7 | E |
| Sept. | 13.7 | ENE |
| Oct. | 14.0 | NE |
| Nov. | 12.5 | NE |
| Dec. | 10.9 | ENE |
| Year | 12.0 | NE |

This table of mean hourly wind speed at Barrow helps to illustrate the fact that in this region, as with most of the Arctic, winds are rather strong and constant on the average. The tendency away from low wind speeds and calm is most important to understand the effective temperatures of the region, but to really understand the influence of wind it is necessary to discuss wind storms. It is the storms, not the breezes, which affect the Eskimo most, because when high winds blow not only is it very cold but the visibility is poor, the ice moves, and game cannot be hunted.

From November 1964 through March 1965 there were 25 "storms" at Wainwright, Alaska, i.e., 25 periods of one day or more with estimated wind speeds of 20 mph or greater, usually with visibility obstructed by blowing snow. These storms often are spaced out through the month so that there are several days to a week of good weather followed by a similar period of storminess. There were three storms of six day's duration and ten storms of one days' duration, the rest falling somewhere between.

Effects of Wind on Activity and Navigation

During stormy periods normal activities are retarded at best, halted completely at worst. According to Boas (16), the reason for starvation during the winter among the Central Eskimo is not scarcity of game but prolonged bad weather, which prevents hunting. By the same token, in Wainwright the only times people ran out of coal, ice for drinking water, or meat were periods of storminess. Even during the coldest temperatures recorded during this study (minus 51° F) men were able to travel by dog team to get coal, to hunt on the ice, or to travel inland checking traps. On the other hand, during one severe January storm at Wainwright the following notes were taken:

> This storm has completely stopped all activity and has kept most people inside of their houses. It is the worst storm that I have ever seen, and was strong enough to make walking outside difficult and uncomfortable. The blowing snow caked itself into the fur of mukluks and parka ruffs, so that they dripped wet soon after you went inside, and it made it very difficult to face the wind. Moreso than any storm so far, this storm literally took the breath away when you faced it.

The most obvious problem created by storms is the cold, since in this region the sub-zero temperatures can be whipped by the wind to a temperature equivalent lower than the coldest temperatures ever recorded in the inland areas of the northern hemisphere. However, only in extreme cases, such as minus 30° with a 25 mph wind, will the cold alone prevent travel by these hardy people. This is particularly true if the direction of travel is with the wind, of course, which is much easier on man and dog alike. Dogs have a strong distaste for pulling into a wind, and often will veer constantly to one side or another if not watched and guided closely. Whenever a man decides to travel in very cold weather he is certain to take a trip which is upwind on the way out and with the wind on the way home, so that late in the day he has the easiest travel.

Hunting on the ice is not done whenever the wind blows from a direction which could cause breaking up of the ice or rapid ice movement. There is a very subtle art to judging the safety of the ice conditions according to the wind speed and direction, an art which is still being learned by the oldest and most experienced ice hunters. The wind is watched most carefully by hunters out on the ice because of the continual danger of drifting away -- often the ice breaks away on the shoreward side of their station. This subject will be dealt with in detail later.

Before discussing the Eskimo techniques of storm forecasting we should consider one more important effect of wind -- the condition of visibility more than cold which often clinches the decision to stay home, to return home before reaching a destination, or to stop and set up an emergency camp to wait out the storm. There is only one advantageous situation as a result of poor visibility, and this is the facilitation of a special type of caribou hunting. During severe storms the caribou either move with the wind or bed down to wait out the storm. A man moving along in a storm can detect caribou upwind of him because their pawing for food sends bits of dried tundra vegetation skittering along the hard snow before the gale. The hunter, seeing this and/or noting that his dogs smell game, moves upwind until he is close enough to detect the caribou, and then moves around to get almost upwind from them. The caribou watch downwind, depending upon their noses to protect them from upwind approach, and enabling the hunter to stalk close under cover of the blowing snow and howling wind.

Usually the Eskimos are very particular about travelling when blowing snow obscures the visibility, because this is the most likely time to become lost and the most dangerous conditions in which to be forced to remain in poor shelters. Not only is there personal danger of becoming lost, but the social ridicule of the person who becomes lost, or tammak, probably is a strong impetus to watch the signs of navigation closely. Hunters, especially the younger men who are learning the skills, are subjected to merciless ridicule and degradation of social position if they become lost or, worse, if they are habitually losing their way.

The best friends of the poor navigator or the man who becomes lost in a storm are his dogs. A lead dog is praised if it is able to find its way home well, and the older dogs are especially good at this. If a man has a young or inept lead dog he will replace it with an older one that "likes to go home" if he feels that he may become lost. In most cases the dogs will seek out the dog trails that lead in the correct direction, but if necessary they can probably guide themselves without this aid. When the hunter wishes his dogs to take him home he sits quietly on the sled and gives no orders to turn, lest he give an incorrect command and confuse the leader. Even though they will swing away from the proper direction from time to time, they will still return to the correct one.

Stefansson (8) has pointed out that dogs are not reliable guides unless they are living in a village, where they are familiar with the trail. Although there is undoubtedly validity in this statement, there are many cases in point which show that dogs are often quite good at finding even a temporary camp. On some occasions men have fallen from their dog sled and lost their team, to have them return to a temporary camp where they had stayed the night before. An actual instance of a similar happening was this one from the writer's field notes:

At the time of the full lunar eclipse I was travelling 1 or 2 miles behind Weir and Burrell, and as the last daylight faded so did the moon. It became very dark, such that almost nothing was visible, and navigation for me was impossible. I let the lead dog find the trail, which he did with his usual infallibility in spite of the fact that the snow was very hard and the area was one where I had never driven him before. The leader went right into camp and lay down at its spot in the dog line.

In spite of the fact that dogs appear to be reliable in the home area, Stefansson's warnings about their use as navigators in strange regions are undoubtedly well-founded. For the traveller in such a situation it would be best to follow the Eskimo axiom: When in doubt, stop and wait for the weather to clear, then continue to the destination. A good example was described, where Kusik waited four days in a small shelter for the weather to clear and then went safely home. The logic behind doing this, even if one has only a few hundred yards to go, is simply the fact that it is too easy to become hopelessly lost and exhausted, and when the weather clears to be unable to reorient and find home. Stefansson (8) suggest four rules to be followed while waiting for the visibility to clear:

(1) Keep still, and move around just enough to keep warm.

(2) Do not overexert or in any way cause the clothing to become damp.

(3) Sleep as much as possible.

(4) At $10^{\circ}$ below or colder, build a snowhouse or snow shelter of some type.

As will be seen later these rules were followed by men who drifted away on the ice, while they waited for the ice to move back toward shore. There are, however, other methods of finding the way to a campsite or village in stormy weather besides depending on the dogs. Most important of these to the Eskimo is memorizing each and every landmark on the terrain surrounding his village or camp, and closely observing the features of land or ice over which he travels for the first time. In this way he will recognize features whenever he comes upon them in a storm and know which direction to travel and how much time should elapse before he reaches the destination.

On the flat and monotonous tundra or the jumbled piles of sea ice the smallest unique features become important landmarks: An upturned rock, a cut in the river bank, an unusually large or strangely shaped pile of ice.

It requires self-training and acute observation to notice these landmarks and to remember their spatial relationships. A very important and easily recognized type of landmark is a linear feature, such as a long ice pile, the recognizable features of an old lead edge, the ocean beach, or cliffs paralleling the ocean or a river. In order to find Wainwright village in a storm, for example, the traveller may head either toward the beach north or south, but never straight toward where the village should be. In this way he knows that when he hits the beach he will turn to the south if he has headed somewhat north of the village, for example, whereas if he headed toward it and missed, he would not know which way to turn to find it. The same method is used to find a camp along a long ridge on the sea ice.

On one long dog team trip it was demonstrated just how much the Eskimos depend upon knowledge of the landscape in navigation. Between Wainwright and the shelter cabin about 40 miles away, where the first camp was set up, the writer's Eskimo travelling companion demonstrated an amazing knowledge of the landscape. He had often trapped and hunted in the particular region and had travelled to the cabin several times. He was able to keep a true line of travel through what appeared to be a featureless landscape and was able to intersect shallow stream beds perfectly when there seemed to be no indication whatever where they would be. He also knew the location of fox holes completely "in the middle of nowhere" in spite of the fact that they were not visible from over a hundred yards away.

On the second day of travel we had passed out of the area where he had ever been with a dog team, and it became clear that his ability to navigate was due to knowledge of the landscape. In this region he knew only what he had seen when travelling along the coast by boat or had heard about it from other men. He could not tell how far it was to the destination, and he knew almost nothing of the landscape even though there were cliffs, hills and buildings, much more prominent landmarks than along the first day's route. On the first day he was able to predict at noon that the cabin would be reached at four o'clock, and was exactly correct, but on the second day he did not know whether we would arrive at our destination at five o'clock or midnight.

On familiar terrain, or in travelling out from a camp and returning later, the Eskimo watches the amount of time passed so that it is possible to know whether he has passed by the village or camp in a storm. If a certain hill or ice pile is half an hour out from the village, after 45 minutes' travel the destination has probably been passed by.

The Eskimos today, as in the past, sometimes mark the trail at important places or turns. In former times men would go out and shoot caribou

or seals and would be unable to carry the entire catch back home on foot. They would leave trail markers along the way such as pillars of snow with willow twigs stuck in them to point the proper direction, and would mark the game itself, so that their wives could go out with the dogs and bring the game home. Near a trapping camp north of Wainwright there were several empty oil drums placed along the trail as indicators to aid in locating the camp in stormy weather, as well as some long sticks in the snow leaning toward the correct direction.

Snowdrifts, grass tufts, and the prevailing winds are navigation aids along the northwest Alaskan coast. The wind direction statistics for Barrow showed that the easterly and northeasterly winds are very constant there, as is also true in Wainwright. When travelling in poor visibility conditions the wind itself can be a guide, if it is watched closely to be sure that it is not changing direction. In a northeast wind, for example, the traveller might try to keep going at exactly a right angle to the wind as he came home in the middle of the featureless Kuk River Lagoon.

As long as the wind and its relation to the drifts is watched, there is no danger of being thrown off course by a gradual wind shift. Snowdrifts themselves are like the needle of a compass, especially in these regions of consistent prevailing winds. When one is flying over the region in an airplane or slowly moving on a dog sled at ground level, the east-west orientation (more correctly northeast-southwest) of the thin elongated drifts is obvious even to the most untrained eye, more or less like a vast striated plain. Common sense explains the fact that the snow, moving before the wind, will form drifts elongated parallel to the wind direction and not at right angles to it.

Realizing then in which direction the drifts tend, the problem is knowing from which direction the wind blew. This problem is elementary in its solution. First, the wind deposits snow on the lee side of any obstruction, whether it be a marble-sized lump of snow or a giant ice pile. On flat areas the surface of the snow is usually studded everywhere with small lumps of snow less than two inches high, behind which is a small "tail" of snow which tapers to a point several inches behind the lump. This small tail of snow was left there because it was on the lee side, the tail pointing downwind and the abrupt flat end forming the upwind side. In most cases the tail points southwest or west. On the lee side of ice piles the snow also accumulates, often in deep soft piles, called mauya. The windward side is always blown free of all loose snow and either bare ice or hard snow (sillek) remains.

Snowdrifts in the open tend to have a long tapered windward end, both in cross section and top view, and a more steep and abrupt leeward end.

This type of drift is called kaiuhulak. This pattern can easily be interrupted, however, by wind eroding the face of a drift. It is important to watch for drifts with one end carved away, with a blunt curved-faced end upwind and a more gently tapering end to leeward.

In this region there are, of course, drifts formed by winds that blow contrary to the usual east-west axis. Most important are the powerful south winds, which occur sporadically during the fall, winter, and spring. The drifts produced by south winds are discernable from those of northeast winds because the former are stout and lumpy, being formed at warmer temperatures than the long and slender northeast wind drifts.

These methods of navigation are of course applicable under various conditions which decrease visibility, such as darkness or fog. Several other methods involving the use of stars, aurora, water sky and so on will be dealt with under the sections on astronomical phenomena, clouds, and sea ice.

## Wind Forecasting

Because of the great importance of wind to the activities of Eskimos there has been accumulated a rather extensive knowledge of wind and storm forecasting. Most of these methods were used centuries ago and require only alert senses to use them, and a few have been derived from the use of barometers and radios.

There are a series of signs which usually forewarn of a heavy wind coming from some direction, and in addition to this there are particular indicators for winds from certain directions. The general storm indicators will be considered first, before listing those for particular types of storms:

(1) Before a storm arrives there is normally a drop in barometric pressure, which begins 12 to 24 hours in advance of the storm. In general, a rapid and prolonged drop means a severe storm, while a gentle and brief decrease either forecasts a small and weak storm, or perhaps no storm will materialize. Conversely an increase in barometric pressure during a storm usually forecasts the end of that storm or sometimes a shift of wind direction with or without a decrease. High barometric pressure generally means clear and calm weather; low pressure means windy and often cloudy weather.

(2) The temperature always reaches its lowest seasonal ranges during clear and calm weather, and increases coincidentally with decreasing barometric pressure before storms. Warming trends preceding storms

tend to be fairly rapid, and in some cases very marked. The warmest winter temperatures occur during and before storms. Temperatures often drop near the end of a storm.

(3) The Eskimos watch the stars each night and note the amount of "twinkling" or "dancing". During clear and calm weather, there is only a small amount, while for a day or two before a storm wind arrives the stars twinkle noticeably. Before a powerful storm the stars actually appear to "dance" about in the sky. During a storm if the sky is clear the stars continue to twinkle, and when this decreases, the storm will probably end within a day. This phenomenon is apparently due to an increase in atmospheric moisture or haze in the air before and during storms.

(4) Another phenomenon which is also undoubtedly related to atmospheric haze is the "moon dog" or "sun dog", consisting of one or two rings or halos around the moon or sun. Usually, though not always, these occur during or before a storm, and are considered important foul-weather warnings by the Eskimos. When the ring disappears it usually forecasts the end of the storm wind.

(5) Haze is also noticeable during the day, before a storm arrives, but this sign is more difficult to notice than those above. However, in conjunction with the occurrence of other storm warnings, this is a meaningful indicator. This haze is not usually heavy, as for instance a fog, but is perceived by a softening of sharp lines near the horizon, or a disappearance of the horizon altogether. Sharp, clear weather contrasts fairly markedly with this hazy pre-storm atmosphere. It is said also that before a strong north wind there is a low fog on the northern horizon.

(6) Many storms are preceded by cloudiness, which usually moves in from the direction the wind will blow. When these clouds bring snow, even though it may be calm at the time, it is an especially good storm indicator. By the same token, snow falling during a storm forecasts the end of the storm. It is difficult for the novice to tell when it is snowing if there is heavy blowing snow, but the technique of discerning the two types is rather simple. Snow which is picked up and blown before the wind (aganik) is granular and almost sandy in appearance. Snow flakes (kanik, aneu) which are falling from clouds above are large, flat and fragile, tending to stick to the fur or cloth of one's parka rather than bouncing off as the blowing snow does.

(7) Before a storm arrives, or foretelling the increase of a wind which has begun to blow, there may be long streaks of clouds coming from the direction from which the storm will blow. These clouds are elongated or "stretched" in the direction of the wind. At Point Hope during May a

fairly strong wind was blowing, but not powerful enough to cause all of the whaling crews to leave the ice. An old man decided that the crews had best pull in to shore because of the long streaks of clouds which were moving in from the southwest.

(8) When there is an open lead offshore and clouds overhead, the clouds above the water are a deep black color, and those over the land or flaw ice are bright white. This "water sky" is important for ice travel, and also can be used to forecast storms. If the black shade is continuous from high overhead right down to the surface, it is an indicator of stormy weather, undoubtedly caused by haze in the air. However, with a lead of the same size, if the water sky hovers above the water with a light color along the horizon, it forecasts good weather.

(9) Several men in Wainwright could apparently forecast storms by the ringing of their ears. One man in particular would mention that a storm was coming if his ears were ringing, and that it would continue or stop depending upon whether his ears were ringing or had ceased to ring. This man also would occasionally complain that a surgery scar on his chest would become painful before and during storms.

(10) Dogs also appear to have a built-in system for forecasting weather. If the dogs howl persistently during good weather it is said that a storm is on the way, and if they howl during a storm the storm will soon end. During nine months in Eskimo villages the dogs seemed to howl almost every night, but did tend to howl more before storms began. It is a certainty that they howled in anticipation of the end of storms, because during very foul weather the dogs do not howl, for several days at a time if the storm is a long one, but when the storm is about to break they always seemed to set up their choruses.

(11) The current is also an indicator of the weather, particularly weather of certain types. Winds from the south and west quadrants usually are preceded by a change in current and rising tide. This will be dealt with in greater detail later.

(12) Seals are said to be able to sense the coming of a storm, and by watching their behavior one can reliably predict the weather. If the seals in the open lead stay up on the surface looking around or resting for long periods of time and appear to be in no hurry to go anywhere, it either means that the weather will remain good or the wind will calm down. On the other hand if they rise only briefly in one place and do not appear there again, and if their heads remain low in the water rather than coming up high, this is a forecast of the beginning or continuation of a storm.

(13) The wind itself can be watched during a storm to predict its continuation or end, especially when the other signs are observed as well. Contrary to what would seem logical, storm winds often increase to a peak before they begin to diminish. On the other hand, storms often decrease during the evening and night, but increase again the following day.

(14) The last general storm forecasting method invclves the use in modern times of the radio. At Wainwright or Point Hope the people learn about the weather to the north and south by listening to a commercial station at Nome and to the daily radio schedule of the B.I.A. school in each village. At Wainwright, for example, the teacher contacts Barrow each day, and usually weather reports are exchanged. On the basis of Barrow's weather the Wainwright people sometimes are able to forecast their own weather. Information on weather to the south is more important because apparently the storms which blow from the south move up along the coast in a more cohesive and predictable manner than north and east storms. Also there are more villages and a better chance to follow storm patterns from the south.

There are some characteristics of each type of storm--the "type" meaning the wind direction in the storm--and these peculiar traits aid in forecasting them. Wind direction, speed, temperatures, and visibility during a storm can to some extent be predicted ahead of time as long as the specific signs are watched for. Along the coast the west wind, for example, does not cause poor visibility but is very chilling. The northeast wind, on the other hand, causes very poor visibility, but does not prevent return to the village from inland camps because it blows in the direction of travel.

Storms from the north and east quadrant are forecast mostly by observing the signs listed above as general storm warnings. It is important, however, to be able to tell whether a forthcoming storm will be from one of these directions or from the south. The method consists simply of watching for the presence or absence of south wind traits. If there is obviously a storm coming, the direction of cloud movement is noted, and if it is from the north or east the storm will be from that direction. If the temperature is not unusually high for the season, the barometer has not fallen too low, and it is not extremely hazy and overcast the storm will not be from the south. Unlike the south wind, the north or east storms may arise without much warning at all, so that it is easy to be caught out on the trail when the gale begins to blow. In most cases this does not occur, and the signs are clearly present well in advance of the storm.

Storms from the north and east are apparently of longer duration during the cold months than are those from the south or west. It is difficult to forecast the end of such a storm, and although several of the methods

listed above are useful, they do not occur near the end of every storm. The most reliable of these is probably falling snow followed by decreasing winds and perhaps clearing skies, but this does not occur too often. The howling of dogs is quite reliable and usually happens near the end of every storm. Also cloud movement contrary to the storm wind direction, or a similar change in the current, would indicate the forthcoming end of a storm.

It is much easier to forecast the south storms, and this is fortunate because these are usually the wildest and most powerful to hit this coast. Storms seem to move up from the south more during the late fall and early spring than during the winter, and the months of extreme cold are relatively free of them. For the traveller the south wind means extremely poor visibility unless the temperature goes above freezing and softens the snow. For the most part this is a "warm" wind, but not always. When it is warm there is less danger of freezing, but the wet snow soaks the clothing and the heat tires the dogs. South storms are apt to rise to heavy wind velocities very quickly, but can die equally fast. On the sea ice the south wind usually piles the ice or causes rapid movement parallel to the shore, being accompanied by a strong current, but sometimes the ice lifted and cracked by high storm tides will be blown away suddenly by a southeaster. North and east winds are, however, more dangerous for ice travel because they blow the ice offshore almost every time they reach storm velocities.

The storm tide is often the first warning of a south wind shift. The northwest Alaskan coast is characterized by very small tide ranges, varying from 8 to 18 inches. The only interruption of normal tides is caused by south or southwest winds, which send a tidal swell of up to five feet ahead of them. During the winter this tide is not seen except by cracks in the ice due to lifting, occasionally with water surging out over the ice, and by a strong current flowing from the south. This occurs 12 to 48 hours ahead of the storm, and according to the strength of the current and amount of rise, the severity of the storm can be predicted. A south current does not always mean that a storm is approaching, because even a moderate southerly wind flow causes the current to change. During the storm the tides are highest, as is seen by the fact that during the open-water season the water reaches highest on the beach during the peak of the storm.

Many of the weather signs which precede the south wind have been listed above. Most definitive of these is the temperature, which always reaches its seasonal high (fall, winter, and spring) during or before a south wind. During December 1964 the highest temperatures recorded, and the only above zero temperatures that month, were a plus 10 and plus 20 on two consecutive days, and these occurred during a brief south storm. The barometric pressure also falls lowest during or before a south wind, and it

is for the prediction of this type of storm that the barometer is most often used. A fairly large number of Wainwright households have a barometer, called anogasiun, and these are not watched closely unless storm indications are present. In this case the glass face of the barometer is frequently tapped with a finger to see whether the needle is moving up or down or has become steady.

Another definitive indication of the approach of a south wind is seen in the clouds. Systems moving up from the south usually bring overcast skies and snow, with the clouds scudding along rapidly toward the north. There are also particular cloud formations which warn of a sudden gale which may arise in a very short time, rather than building up gradually as is the usual characteristic of these storms. Hunters out on the ice when there are south wind indicators will watch the southern horizon for a dark black cloud. If the sky should begin to darken heavily they will leave the ice quickly, because such a cloud warns of a sudden gale.

A very singular phenomenon is the bright red "cloud" on the southern horizon which also warns of the approach of a gale. After having been warned several times to watch for such a sign, the writer was able to observe firsthand its appearance. During the afternoon and evening of March 8, 1965, the typical forewarnings of a south wind began to appear, notably with rising temperatures and cloudy skies. On March 9, the signs increased as the temperature reached plus 20, and while the sun was still high in the sky, there was a reddish tinge in the clouds on the southern horizon which resembled a sunset. Two hours later the light northerly breeze had changed to a stiff southerly wind, which later rose to a gale.

Of the various winds which blow from the south, the southwest storm is said to be the most powerful and the longest lasting. One's impression is that the southwesters are colder than the warm southeaster, but the writer has not seen statistics dealing with this possibility. There is one peculiar type of "south" wind which actually blows from the north. The Eskimo word for this phenomenon translates as "false north wind", and according to the native theory there is a southerly circulation aloft which "turns under" somewhere to the north and blows from that direction at the surface. The fact that the clouds do move from the south during such a wind substantiates the theory, as do the additional characteristics of falling barometer, high temperature, clouds and snow, and south current. When the "false north wind" blows there is always a good chance that the wind will shift to the south, although this never happened during several such storms at Wainwright during the winter of 1964-1965.

The west wind blows directly onshore along the northwest Alaskan coast, piling the ice or holding it tight to the shore. Seal hunting is spoiled

when this occurs because there are no open cracks or leads in the ice, but conditions are excellent for polar bear hunting because there is no danger of drifting away on an ice floe. The wind blowing off the ice is not able to pick up the snow as it does on the tundra, so that along the coast and on the ice there is always good visibility during west winds. The reason for this is either the stickiness of the snow on the salt ice or possibly the rough terrain of the sea ice obstructing the wind and blowing snow.

West winds usually occur, during the winter, following the development of south wind indicators or after a south wind blows itself out. Less is said by the Eskimos about the westerly gales than any other type of wind, probably because these winds are usually brief and not very strong, and the direct consequences of the west wind are the least important. Quite infrequently all of the signs indicate a south wind--with high temperatures, falling barometer, clouds, etc.--and when the storm seems eminent the wind shifts clear through the south quadrant and into the west. In this case the barometer will rise suddenly, accompanied by falling temperatures and clearing skies. Then the wind blows for one to several days, often strong enough to be extremely cold, before shifting, usually through the north quadrant, to the northeast or east.

Sometimes a south wind will blow for a day or two and then begin to diminish noticeably. If it switches to the southeast it probably means that the wind will become heavy again, but when it switches to the west the severe storminess is assumed to be over. West winds always bring fair skies and clear weather to the coast, but inland there is likely to be considerable blowing snow.

## IV

## ATMOSPHERIC PHENOMENA

### Snow

Although the tundra and sea ice are snow-covered for about nine months of the year, the total amount of snowfall is actually quite small. At Barrow the average annual snowfall is 26.1 inches, with the greatest amounts falling in October and November. This is a considerably smaller total than many midwestern cities receive annually. The total annual precipitation is very slight, amounting to some three to six inches per year (13), which would give the area a distinctly Saharan climate if the temperatures were higher.

During the entire winter of this study the tundra was seldom completely snow-covered except after a rare windless snowfall. Both land and sea ice are usually covered with snow ranging in depth to 30 feet, depending upon where the wind sweeps the ground clear and where great drifts are deposited. These drifts can be a great aid to travel on the rough sea ice, where they smooth over the rough and jagged ice piles with a hard-packed snow surface. In the spring, however, these drifts are converted first to great piles of soft wet snow through which travel is impossible, and later into deep water puddles on the ice surface.

The rare deep snowfall raises real havoc with any sort of travel until the wind can harden it. At Point Hope there was a heavy snowfall in early May 1964, which covered the land and ice with one to three feet of soft thick snow. During the time before a storm hardened the snow, travel by dog team was virtually impossible and walking on foot was worse. The fact that such snowfalls are rare, and the Arctic snows are usually packed into a pavement-like surface, makes these regions the best on earth for dog team travel. The modern Eskimo with his large dog team seldom is forced to walk alongside his sled, as the inland inhabitants must usually do even with the largest and strongest dogs. The section on dog teams will deal in greater detail with snow conditions and their effect on travel. Suffice it to say that the winter snow surface of the Arctic offers excellent conditions for foot or dog travel except in places where the surface of the sea ice is piled and heaped so that it is virtually impassable by any mode of travel.

Snow is also important in the Arctic because, being pounded hard by the wind, it can be handled and worked into shapes of use for building materials. The snow house has been discussed previously, and is dealt with in detail in many available works. Suffice it to say that snow possesses excellent insulating qualities and facilitates itself to being easily cut, removed, and piled into whatever shape is needed. In addition there is the advantage that the snow blocks forming a wall or roof will solidify and fuse together, making a very strong and effective structure. Of course the snow which is used must be neither so soft that it will crumble when handled, nor so hard that it cannot be cut and shaped easily.

Snow is also used for keeping killed game from freezing too hard to butcher or handle easily. Caribou which are killed and left behind for later retrieval may be laid belly down with the feet folded under, with snow piled all around the flanks to prevent extreme cold from freezing them too solidly. Killed seals may be buried in snow to prevent them from freezing so hard as to make them difficult to pull home through the rough ice when the hunter is on foot.

On the sea ice, except for that which is a full year old or more, the snow is often somewhat wet, deriving its moisture from the salt ice beneath it. On young ice the snow is always wet even if it is fairly deep, while on somewhat older ice only the snow near the bottom is wet. The moisture contained in snow on the ice is avoided by not sitting on it without extra cloth or fur as a seat and by placing something between the snow and the sleeping bag, a procedure which should be followed on any cold surface. This moisture, being derived from salt water, spoils the affected snow for use as drinking water. Therefore, snow for water is taken from deeper drifts or from the very top layers when on sea ice.

The salt and moisture contained in the snow on sea ice also causes it to be very sticky and slow for dog team travel. It is therefore necessary to use iron shoeing on the sled runners whenever a sled is to be used on the sea ice, and the hardwood shoeing used for inland travel is seldom seen on the sea ice.

## Clouds

The second important atmospheric factor is clouds. During the winter and spring months, when there is sea ice cover, there is a high percentage of clear days. "At Point Barrow there is a yearly average of 8.9 clear days per month, but the winter average (excluding June, July, and August) would run closer to 10. The percentage of clear days runs from 51.1% in March to 9.8% in September, with an annual average of 29.8%. The average percentage of partly cloudy days is 23.6% and of cloudy days is 46.6% (11).

The importance of clouds to the sea ice traveller is their effect on visibility and navigation. They are, of course, an aid to weather forecasting, as has been shown previously, and can be forecasted to the extent that they occur with certain weather patterns. During the winter period, when the sun remains below the horizon for over two months, it is most fortunate that the weather is dominated by the clear northeasterly flow. The darkest winter nights and days are those during which the sky is shrouded by overcast. The "day" length, or time during which there is light sufficient for travel, is reduced from little to almost nothing by cloud cover.

Of course the Arctic winter at these latitudes is not devoid of sunlight, and is brightened by several periods of moonlight. However unlike the sun, the fullest and highest moon can have its effects severely reduced by clouds. Equally important is the fact that the uniform white of the ice and snow blends into a confusing nothingness when the light is diffused by clouds. In this case, sometimes referred to as a "whiteout", there are no

shadows and therefore no ways of discerning relief on the ground. On such days or nights the eyes must strain in order to walk or pick a trail for the dogs, much less hunt for animals. Cloudy skies which occur after March or April also create conditions for snow blindness and necessitate the use of sunglasses. Clouds are also a deterrent to navigation because they block out the sky, making it impossible to see the sun, moon, stars, and aurora borealis.

But in spite of the fact that clouds often create difficulties for the Eskimos, they also can be of service to him. On the sea ice they are an aid to navigation, hunting, and the planning of a travel route. Whenever there is sea ice and coastal land in juxtaposition, with an overcast sky above, the ice will be reflected in the clouds as a dull white and the land as a brilliant white. It is possible to trace the trend of the coastline far ahead of one's position by this sky map, and to tell from out on the ice which direction to travel to intersect the land. The most pronounced type of sky map, however is the water sky, which traces the relationships of the ice and open water in the clouds. This water sky is reflected as a deep black color, differentiated sharply from the white reflection of the ice. If the clouds are high, a larger area is reflected in the water sky and more information regarding the position of cracks, trend of the edge of an open lead, and distance across open leads can be discerned. If the water sky is overhead, the water is close to one's position, and if it is lower toward the horizon, the water is some distance away.

The people at Wainwright watch for the water sky, which they call kissuk, after each strong offshore wind. Before the blowing snow has cleared they can see how high the water sky appears overhead and know how far out the open lead will be if there is one. It is always hoped that the kissuk will show its dark hue almost over the village, meaning that the lead is probably less than a mile offshore.

To the practiced eye it is possible to read much from the sky map regarding the ice and the leads. Stefansson was able to tell smooth ice from rough ice surfaces by the colors of the sky map, although the writer never learned the skill nor did he hear of it from the Eskimos. Smooth ice is said to be reflected as a uniform white color, while pressure ridges and rough ice reflect as a mantled effect. Freshly-frozen leads reflect as a black color nearly the same as open water, while freshly snow-covered leads reflect as unusually white ribbons.

The water sky is of value to the Eskimos in planning their hunting activities. First, the water sky is used, whenever present, to tell if there is any open lead offshore from the village, or to the north or south. When a lead first opens or if it is closing this is especially important because the

hunter can decide if it is worthwhile going out and in what direction he should travel for the best hunting. The water sky may show open water very far offshore in front of the village but quite close to the north. If the ice is closing in, this may also be revealed, as well as where it is likely to close last or where open spots remain.

As an Eskimo hunter approaches the lead edge he again watches the sky map to see where there are points and bays along the edge so that he knows which area should be the best hunting spot and/or the safest ice. If he should go too far out or by some other misfortune or miscalculation be caught on the far side of an opening lead, the first warning may be a dark streak across the sky between the hunter's position and the land. It is possible to tell from the sky which direction to travel to find the narrowest part of the opening lead, and perhaps to see ice bridges reflected above.

The water sky or sky map is an important aid to the sea ice traveller and hunter because it enables him to see what is beyond the horizon or beyond his range of vision on the surface. On sea ice this is important to the hunter mainly because ice can be very rough and travel is slow, without his having to move along on a trial and error basis. It also is important therefore to consider what the writer terms "steam fog", a much more common phenomenon in northwest Alaska.

Fog

During the winter there is seldom any fog in this high Arctic region, with the exception of mildly restricting haze of occasional ice crystal fogs. During this season the only common type of fog is that which forms due to contact of salt water with air that is more than $14.4^{0}$ C below the temperature of the water. In winter, however, the difference in temperature reaches as much as $40^{0}$ C (17). This type of "steam fog" over an open lead is called by the Eskimos puguroak, or in the case of streamers of fog rising from small open cracks or holes it is called puvoalagaa. These types of winter fog can occur only under particular conditions:

> It is necessary for the extremely cold air to be covered above by warmer air (temperature inversion), which limits convection. In such a case, slight evaporation causes supersaturation. But the simultaneous heating may be insufficient for the formation of convective currents. Therefore, the formation of winter fog in the sea can take place only over ice or intensely cooled land--from which masses of very cold air may reach the sea.

**Such fog formations during severe frosts are observed not only over spaces and cracks in sea ice, but also over thin ice. In open portions of the sea, only summer fog is possible. This, in contrast to the winter fog, is formed only over a colder sea surface or over ice (17).**

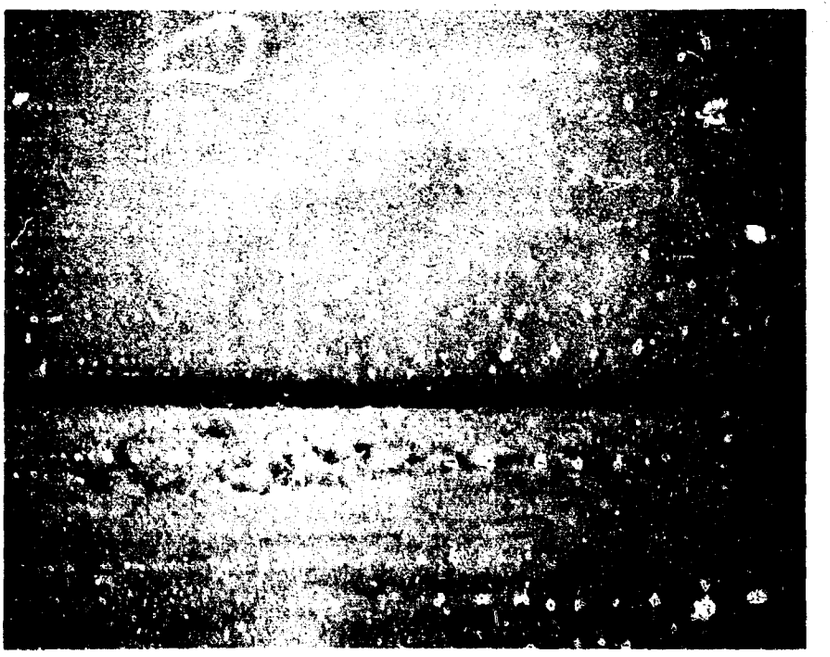
This type of fog occurs very commonly, virtually every time the ice opens in winter, because over the sea ice there is a temperature inversion present. The surface of winter sea ice acts much like the land, causing intense back radiation of heat, and therefore creating a situation where the air stratum near the surface has a temperature which is lower than the air higher above. This is sometimes shown in cold, calm weather by the leveling off of smoke from the chimneys of Eskimo houses at a point 50 or 100 feet above the roofs.

Because this fog does not form over thin ice unless the air temperature is quite cold, it is sometimes possible to tell whether a lead or crack is covered with new ice or is open water. This is only possible when there is a water sky present at fairly cold temperatures, when there would be steam fog rising off the water as well as a dark water sky above. If there is no steam fog present when there normally would be, the water sky must be the reflection of black young ice.

But before describing specialized features of the steam fog phenomenon, it is best to give its general characteristics. Whereas the water sky hovers fairly high above an open crack or lead, the steam fog reveals itself usually as a very dark haze right at the horizon and extending not far above it. At times it resembles a prairie fire along the distant horizon, with black smoke instead of white. Hovering above the steam fog there is always a "steam cloud"; a long stringy cloud which stretches out over the lead for miles. In most cases this steam cloud is all that is visible when the lead is in the far distance, perhaps 10 to 20 miles away. On clear days it is obvious to the Eskimo that there would be no clouds in the sky except over the lead, and that certainly a long stretched-out cloud or series of clouds just above the horizon means open water.

Steam fog also rises from small holes or cracks, but of course is much more difficult to detect from a distance than fog rising from a wide lead. A series of thin streamers rising out over the ice, usually disjointed but obviously in a line of some sort, means that a lead is opening or there is a narrow crack. Widely-spaced steam fogs and steam clouds may simply indicate holes which have opened or have not closed when the ice comes in to cover a lead. These phenomena are of course difficult to describe, unless they are demonstrated right on the sea ice. To some extent this type of knowledge must come from experience, and cannot be described

Heavily piled ice near Barrow, Alaska. The dark horizon is caused by steam fog rising from a lead approximately one-half mile away.



Water sky revealing a distant open lead. A low heavy overcast caused the dark reflection to appear close to the horizon rather than high above it.

because it almost amounts to a "feeling" which is slowly acquired. However, a typical steam fog or water sky will be immediately apparent to anyone who has had it described to him. It is easy to mistake a rather dark haze, which always occurs on the horizon of the sea ice, for steam fog. The error will be made as long as one is not carefully watchful for the everpresent steam cloud hanging over the low-lying fog. The cloud will sometimes be seen, in fact, when there is no visible ice fog, usually on clear days with a near zero temperature.

Steam fog is visible to varying degrees according to the light. Fortunately, it is visible as long as there is some light available, either sunlight or moonlight. At night the steam cloud is not visible, but the fog shows as a deep black separating the gray ice horizon and the dark blue of the sky. In fact it may be easier to see the steam fog at night than during the day, depending upon the relative position of the observer, the sun, and the fog. When one is travelling from Wainwright to a lead paralleling the shore, the morning sun shines onto the fog to the north and west, revealing it as a black cloud of steam. However, to the south and southwest the black will not be revealed, but the fog will appear as a rather faint white steam, due to the fact that the sun shines more or less through it. From a position between the sun and the fog it is therefore much easier to discern the steam fog than from a position where the fog is between the observer and the sun. When one attempts to sight the trend of a lead or the position of open water it is much more simple and reliable, then, to do so in certain directions than it is in others.

This has a bearing on one of the very important uses of steam fog by sea ice hunters. When the sky is clear, a warning of ice breaking away between the hunter and the shore is usually given only by the appearance of steam fog. At times of potential danger he will watch carefully toward the shore again and again, being assured that he is not on the far side of a widening crack. If the sun is in a position behind the steam fog it may be more difficult to detect a crack and the danger of being set adrift is greater. This fog can, of course, be the guide to crossing a lead, by watching for areas where it is not rising, an indication of solid ice. Much the same as is true of water sky, this phenomenon serves as a guide to the hunter before he goes out onto the ice and after he is at the edge of the lead, because from it he can trace the position and outline of cracks, leads and openings.

By the same token the steam fog can be a hindrance, because it cuts down visibility at the lead-edge, affecting the ability to see game and to reconnoiter the size and trend of a lead. It is said also that drift ice survivors have great difficulty because of the darkness if they drift away during mid-winter. The far side of a lead is usually the downwind side, so that the thick steam fog blows out over the ice, darkening the sky both

"day" and night. On March 21, 1965, the writer noted: "This is the first time (all winter) that the opposite side of a lead has been visible, because up to now the steam fog has limited visibility over the lead. No steam fog was present today."

When the temperature is minus 30 or 40 there may be only 20 to 30 yards visibility at the edge of the lead, which makes it difficult to spot seals until they are very close to the edge. In addition, the visibility is further reduced whenever a camp stove is started by the hunters to make tea, because the breeze carries the heat out over the water and causes increased steam fog. The same thing is caused by the heat of a rifle when it is shot, such that a man who shoots at a seal may not know for 15 seconds if he killed the animal because it is hidden in a thick line of fog if it was downwind from him when he shot. This effect even carries over to the smoke and perhaps the heat of the village, such that the fog downwind of the village will rise heavier than anywhere else along the lead.

Finally, the phenomena which the Eskimos call iñipkagaa should be mentioned, since it could be mistaken for steam fog by an unpracticed observer. This consists of a bright white "cloud" hanging just above the horizon. These white lines are fairly stationary, but appear to spread out along the horizon and/or diminish during the course of a day. The white usually does not contact the horizon, there being a dark area separating the white ice from the white refraction. This is not fog but an optical phenomenon typical of the Arctic, which sometimes causes ice-scapes to loom above the horizon. It is characteristic of clear weather, when there is no open water at all in the vicinity. If there were open water, fog would probably be present and conceal the refraction. Steam fog is not so white, nor does it usually appear as a very thin line along a distant horizon, separated from the horizon by a dark line. Having seen a photograph of the phenomenon, and of steam fog, should suffice to eliminate the possibility of confusing the two.

## Rain

During the winter months at these latitudes rain is almost unheard of. However, by March it is possible to have a wet fog, drizzle, or rain associated with a weather system from the south. By May, rain is not uncommon, and these late spring rains help to thaw the snow quickly.

Except for the late spring, there is so little rain during the sea ice season that no special techniques are required to deal with it. In fact, the Eskimo will simply carry on as normal while a light rain falls, or if the rain is heavy he stays under shelter of some sort. Rain is more important

for its effects on dog team travel, because it creates an ice crust over the snow which cuts the dogs' feet and makes the sled difficult to pull if the crust is too weak to support it.

In March 1965 there was a soaking rain for several hours on an afternoon when many seal hunters were out on the ice offshore from Wainwright. There were few seals seen by any of the hunters that day, so about 20 of them gathered together to drink tea and talk while watching along the edge. The rain fell harder and harder, but the men stayed as though it were simply an unseasonably warm day, ignoring the fact that their clothes were completely soaked through. Of course had they been required to stay out on the ice overnight they would have done everything possible to avoid becoming soaked, but they were all returning home where their clothing would be dried over the stove.

This same rain was followed by a west wind and sub-zero weather, which created a heavy ice crust over the snow everywhere. For several weeks this crust was present in many places which were swept clean of snow, and was a detriment to walking or driving dog teams. In this case it was so thick that the dogs and sled did not break through, and the surface was so slippery that dogs literally fell down while pulling.

The same was true for walking, because ice covered the steep sides of snowbanks and drifts. Even under normal winter conditions it is difficult to walk over the hard surface of large drifts because they are very steep and slippery, especially for the smooth soles of skin boots. This condition is worse in the village itself, where drifts 20 to 30 feet high are deposited in the lee of the larger houses. To some extent this occurs on the sea ice, where long and high drifts form behind rough ice. When such drifts become covered with a slick ice coating, it is virtually impossible to walk over them.

## V

## ASTRONOMICAL PHENOMENA

### Sunlight and Darkness

Activities of the Eskimos are profoundly influenced by the period of daylight and darkness. In this respect the Arctic is a region of great extremes, there being at Point Barrow 72 days when the sun does not rise above the horizon and a similar period of continuous sunshine. However, it is of much greater significance to note the period of light sufficient for travel than the actual position of the sun.

At Wainwright the sun rose for the last time on November 21, 1964. On this date it was very clear, so the sun was visible during the 15 or 20 minutes that it was above the horizon. In the Arctic the sun may be seen for several days after it has actually set for the last time, because of the refraction of the atmosphere projecting the sun's image higher than it actually is. The sun was not seen again until January 24, 1965, although it was probably above the horizon several days earlier. In this case there were several stormy days, when blowing snow reduced the visibility and the sun could not be seen.

This brings us to the important factors influencing the period of light sufficient for travel. During the entire winter there is always fair illumination during some part of the day, even though the sun never rises above the horizon. On December 21, 1964 the dim twilight lasted from 11:00 AM. Although the sun is well below the horizon there is clear air and bright snow to help create fair light outdoors. However, as mentioned above, the presence of clouds diminishes the daylight period and brightness. If skies are overcast the period of light sufficient for travel is cut down by two or three hours, and is almost non-existent during the very darkest time of the year.

Eskimos are very particular about travelling when it is light outside, because night travel is regarded by them as highly unadvisable practice. They will always plan to travel so that they can camp or be home well before dark, and prefer to camp too early rather than wait until it is starting to become dark. This is also true of ice hunting, although the men often stay at the edge of a lead until dusk because there is supposedly good hunting at that time. However, it is uncommon for a hunter to go out onto the ice late in the afternoon lest he be forced to return after dark. It is said that those who travel after dark are "crazy people".

Night travel cannot, however, be avoided. During the very brief days of mid-winter there is not enough time to hunt unless departure is before daybreak and, often, the return is well after darkness has fallen. Seal hunters are especially prone to leave the village in time to reach the edge of open water just before the first light of day. They often wait for a while before it is light enough to take the first shot. It is the late afternoon and early afternoon that sends them hurrying home, and few men will tarry at the lead edge long after it begins to darken. Of course there is little need to remain there late because hunting requires even more light than travelling.

It sometimes appears to the outsider that the Eskimos could just as well do their travelling to and from hunting and trapping camps during the brightly moonlit nights. This is almost never done, no matter how bright

it may be outside, and the occasional non-native who does it is considered either foolish or brave. This attitude was never explained further than to say that night travel is dangerous and it is just as easy to wait for the daylight. The danger of being caught in a storm is probably one reason, and perhaps a certain element of irrational fear is involved.

In the spring the sun returns and the land is brilliant white during the lengthening days. This intense light facilitates excellent hunting and long daylight hours for travel. It is during this season that the Eskimos have always travelled to visit neighboring villages. From Wainwright they make the 100-mile trip to Barrow, camping once midway or occasionally traveling non-stop when there is 24-hour daylight. At Point Hope there are many visitors who come by dog team, umiak, or airplane from Kivalina, Noatak, and Kotzebue for the whaling season. Springtime weather is usually ideal for travel, and although most of it is done on the beach or tundra, the sea ice remains excellent until large water puddles form in May or June.

Twenty-four hour sunshine begins on May 26 at Point Hope, but at Barrow or Wainwright it begins fairly early in May. By April 10, in fact, it is light enough to travel day or "night" at Wainwright. If the weather is cloudy, this pattern is altered somewhat during the darker hours, but the transition from winter darkness to long spring days is rapid, and soon it is always bright regardless of clouds.

## Moonlight

Early in spring the effect of moonlight decreases, until the presence of the moon no longer is noticed. But during the late fall and the dark winter the moon is present for about two weeks each month, and its arrival is anxiously awaited. The moon first appears as a small sliver low in the afternoon sky, and for several days it rises only briefly and does not cast appreciable light. It is soon above the horizon for 24 hours each day, and at the same time it becomes full. When the moon is present and the skies are clear there is no darkness because the bright moonlight is reflected everywhere by the snow, making twilight all night long. At such times it is possible to read outside at any hour and would in fact be possible to hunt seals very easily. Travel by moonlight is no more difficult than travel in the evening, which makes navigation rather simple during the periods when the moon is high. As long as there is dark night, the moonlight can be an aid to travel. Like the sun, the moon can be used for a compass, as long as its position at various times of the day is known.

## Stars and Aurora

There are of course times when the moon is not present. After 10 or 12 days it begins to wane and become "lazy", sinking lower on the horizon each night. Soon there is no longer any moonlight, and the land is plunged into complete darkness for many hours each day. At this time, especially if there are clouds in the sky, there are almost no visible landmarks except for those markers along the trail that can be seen with a flashlight. It is even difficult at such times to walk, because the irregularities of the ground, ice, and snow are invisible in the blackness.

If a man is forced to travel at such times he must depend upon feeling the snowdrifts and allowing his dog to find the trail, but he can also use his knowledge of the stars and the aurora to guide him in the proper direction. It is said that in former years those Eskimos who were cast away on drifting ice floes could guide themselves home only by using the stars and by walking along against the direction of the current and wind to stay parallel with their village or camp. Nowaday's there is less dependence upon the stars for navigation because fewer men travel at night or are cast away on the ice, and there is a general depreciation in knowledge of such skills.

The big dipper (Ursa Major) is most frequently mentioned with regard to star navigation. It is an excellent "compass" because the time of day can be told from it. By memorizing the angle of the constellation to the horizon at various times of day, and the position in the sky at certain times, it is possible to get one's bearings from it. For example if the "handle" is parallel with the horizon at 6:00 PM and it is known that the constellation is always in the west at that time, the direction can be derived by this observation.

Contemporary Eskimos universally own watches, and are able to use these for navigation. Thus the position of a star, constellation, or the moon at a particular time of day can be learned and used for direction-finding. Many of the Eskimos also own compasses which they call taktoksiun (taktok= fog, siun= instrument for). The compass was never seen in use during this study except as an indicator of ice breakup, and apparently is of little importance for navigation.

There is one recent innovation which has had a very pronounced effect on the Eskimo methods of navigation -- the electric light. Near Wainwright, Barrow, and Point Lay there are not only many lights from the houses and buildings, but also high towers with lights on them at the Dew Line sites. Many of the stories which were told about being caught in storms or becoming lost eventually related the sighting of the Dew Line beacon and finding the way home. Others tell of becoming lost because of

being unable to locate this landmark, or of having travelled so far from the village that it was no longer visible. These towers and lights are probably visible for 20 miles, especially at night, and stories are told of unusual atmospheric refraction making the Icy Cape light visible from Wainwright, 50 miles away.

Many of the houses in the northwest Alaskan villages now have electric lights, and all of them have at least bright gasoline lanterns. These lights always mark the village from far away, especially from out on the sea ice in the case of Wainwright. Several houses have "hard lights" or lights up on towers, which are an even greater aid to navigation. This condition differs greatly from that of pre-contact times, when there was no light except a faint glow through the gut skin window on the house roof to show the location of a village. This probably helps to explain the loss of native skills in navigation by heavenly bodies. It would indeed be difficult for them to do without these landmarks, especially the high towers and beacons of the Dew Line stations spaced every 50 miles along the coast.

The only other means of navigation to be dealt with here is the aurora borealis. Several men mentioned, when asked, that the northern lights are sometimes used for navigation because they always are oriented in bands from east to west across the sky. Throughout the entire winter, notes were kept on the auroral orientation, usually observed around midnight. The results of this check show a monotonous regularity at this hour, with this east-west orientation showing in virtually 100% of the observations, whenever there are long cohesive bands. There is also a characteristic curvature of the bands such that the ends point toward the north. It is therefore possible to become oriented by observing the auroral bands.

There have been detailed studies on the northern lights by scientists, such as those doing research at the University of Alaska. From these studies it is possible that more could be learned of navigation by auroral bands, and these could be compared to the knowledge of the Eskimos. It is worthy of mention that the more spectacular displays of aurora produce light which can aid the traveller if there is no moonlight. During 1964-1965, a quiet year for aurora, this happened rather infrequently.

## VI

## SEA ICE: EARLY STAGES OF DEVELOPMENT

### Introduction

For several thousand years the Eskimos have inhabited Arctic coastlines, perfecting an adaptation to one of earth's most unique environments.

Within this environment there are two principle divisions, the land and the sea, both of which are the habitat of the Eskimo. On land it was necessary for him to learn intimately the behavior of the game he pursued, but little attention needed to be paid to the ground over which he travelled. On the winter sea ice that covers the ocean there had to be a twofold adaptation; not only must the behavior of the game pursued from the ice be understood, but it was equally important to know the behavior of the ice itself.

The resource of the sea during the winter is too rich to be ignored, especially in an environment that provides with such frugality. In many parts of the Eskimo domain the sea ice is not at all quiet and stable, but constantly in motion, sometimes imperceptibly slow but with a hugeness which betrays tremendous energy; sometimes almost violently rapid. The sea beneath the ice supports an abundance of life in the form of invertebrates, fish, mammals, and sometimes birds. And only two predators are able to survive by moving over the winter ice in pursuit of this game -- the polar bear and man. Of the two, the bear is most at home on the ice, because he rarely forsakes it in favor of the land. Men are only able to hurry out over the ice during its most quiet moods, returning to the safety of the land with whatever spoils are taken.

In order to evolve this adaptation to the sea ice, the Eskimos have made a ceaseless study of the ice, watching its every move and experimenting with many different methods of avoiding its dangers. Sea ice is indeed dangerous, mostly because it is continually subject to the will of the wind and the forces of the current. But were it not so, it would not be nearly as productive for predatory man. Regardless of how and why it has been done, the Eskimos have amassed a large body of knowledge of the sea ice which permits them to move in comparative safety over it during their everyday activities. They are experts of sea ice lore, and we who know so little of it can learn from them.

Much of what is learned from one group of Eskimos should apply to sea ice wherever it is found, and this covers a huge area of the earth:

> The entire area of the Arctic basin together with its seas is about 8,800,000 square km., and the White Sea, with an area of (about) 95,000 square km. can be counted as ice covered in winter. The ice area of the Barents Sea toward the end of the winter is, on the average, ca. 1,000,000 square km. The ice area of the Greenland Sea in April - May reaches 900,000 square km. The total ice area for the whole Arctic Ocean in winter reaches 10,800,000 square km.

By the end of summer, an average of 1,500,000 square km. melts in the Arctic Basin, about 95,000 square km. in the White Sea, and around 250,000 in the Barents. Further, over 1,250,000 square km. of ice is carried off annually from the Arctic Basin into the Greenland Sea, where fundamentally, it melts. Thus, by the end of the polar summer, the ice area of the Arctic Ocean decreases to 8,000,000 square km., due to melting (17).

## Formation of New Sea Ice

During the late fall the gradual appearance of the sea ice is watched with interest by the Eskimos. The ice does not form early, considering the latitude, nor does it form rapidly once it has begun to freeze. Of course the sea ice is seen first at Barrow, the northernmost settlement, where it appears late in September or early in October. At Point Hope there is no newly-formed ice until late October.

In the fall the young sea ice is erratic in its condition and occurrence, being subject to the slightest wind or current in its movements. Young ice does not gradually extend out from the shore-line as a large expanse, thickening as the season progresses. Rather, it forms out at sea, far from the sight of the shore, and appears whenever an onshore wind or current brings it up to the beach. On cold fall days, ice slush forms along the shore, but does not attain any degree of thickness because it usually is carried away continuously by the current and prevailing easterly winds.

In 1964 it took over one month from the first appearance of ice slush along the shore until the solid young ice finally was carried ashore and grounded, so that it remained until the following spring. On October 13, 1964 there were a few scattered patches of ice slush, extending out only 15 feet from the shore. The temperature on this first day of ice formation was plus 15° F. Until September 26 the slushy ice remained along the coast, spreading in wide patches over all of the visible ocean, when the wind and current were slight, and disappearing whenever they increased enough to carry it away. This slush ice reveals its presence easily because it dampens the wind ripples, but is barely visible if there is no wind.

On September 28 a fairly solid cover of pancake ice, consisting of circular pieces of newly-formed ice packed together in a wet grey mass, was blown ashore. This ice cover lasted for only one day before being carried away by the east wind. Slush and pancake ice appeared again on November 2, gradually thickening to a solid cover over several days' time, finally

followed by the appearance of young ice perhaps a foot thick. This heavier young ice (sikuliagqzoak) reveals itself by a white coloration, unlike the gray color of thinner ice.

The north-flowing current which brought the young ice ashore was followed by a heavy east wind and an offshore current, which again blew it all out of sight on November 16. On the 19th a south wind began to blow, bringing in first slush ice and pancake ice, and on the 20th a strong southwester piled and grounded heavy young ice. The first ice hunting was done on November 24, 1964, as compared to November 22 the preceding year.

During the fall there are, therefore, no extensive fields of thin young ice along the coast. The first hunting is done on thick, solid ice, with little necessity of moving over large thin ice areas. In the vicinity of Wainwright there is a large saltwater body, in which the ice forms in situ with little or no movement -- this is the large Kuk lagoon. The Kuk (kuk = river) is a submerged river outlet which measures perhaps 5 miles across and runs about 20 miles inland before narrowing and becoming fresh. In this closed-water body the ice had formed by September 20, 1964, but was not safe for travel for two or three weeks. There are powerful currents flowing in and out of the lagoon, caused by the storm tides. When the tide rises preceding an autumn south wind, the ice of the lagoon cracks and floods all along its shores for some 40 miles inland. This flooding then refreezes over the top of the ice, creating an excellent "highway" for dog sled travel.

This flooding also creates dangers, because the young ice may be solid in some areas and weak in others. During the fall of 1964 the lagoon flooded just before many hunters travelled inland to hunt caribou. Several sleds and men broke through the young ice while crossing it or travelling along on it before it was safe. The writer's first experience on saltwater ice was travelling over the refrozen "flood" in pursuit of caribou and having the sled sink beneath him. Since young salt ice is flexible rather than brittle like freshwater ice, it is advisable to stay on the sled and keep it moving. If it should stop, the sled would slowly sink through the ice, but as long as it is moving the ice will probably bend but not break. The hunters who travel on this ice before it is very thick, test it with an axe or pick to see how solid it is, and are able to judge it expertly this way. Unlike ocean ice, the lagoon ice cannot be judged for safety simply by color, because of the impurities, such as sediments, contained in it.

Out on the open ocean there is likely to be young ice at any time, because it forms whenever the ice moves enough to open cracks or leads. All winter long the open leads offshore are freezing and refreezing, and this is the best opportunity to observe the cycle of new ice formation and

the development of young ice. The Eskimos say very little regarding the actual formation of sea ice, and in fact do not concern themselves with this as much as with the methods of dealing with newly-formed ice and, expecially, the characteristics of ice which has become thick enough to support the weight of a man. The following notes are given as a brief background which will help in understanding the special characteristics of sea ice which are important to the Eskimo. They were derived largely from a translation of Arctic Ice, which was written by N. N. Zubov (17), a Russian authority on sea ice.

Ice formation can begin in the sea when temperatures are above $0^{\circ}$ C if certain conditions are fulfilled. The sea must be calm and the skies clear, with the sun dropping toward the horizon. This also requires that the surface water layer is thin and differs sharply from the layers below, and radiation from the surface must be strong. The first stage in the formation of surface ice is the development of small needle-shaped crystals, which spread and thicken to form a film over the surface of the water. It is this "slush ice" (ugurugizak) that dampens the wind ripples wherever patches of it are formed. In a calm sea, slush ice thickens enough to form an opaque skin of ice called "nilas" (salogok). Nilas is very flexible, bending with the waves and when broken, gathering into clumps of pieces. If there is turbulance on the water surface, this new ice forms into disks from one to six feet across, with raised rims caused by striking together along the edges (18). This condition rarely occurs in leads or cracks, and is usually seen only during the fall freeze-up. Snowfall on the sea surface accelerates ice formation by cooling and freshening the water and providing nuclei for crystallization into the water.

All sea ice does not form on the surface. Deep ice forms beneath surface ice, whenever there is a layer of fresh water below the surface caused by melting of ice floes. This fresh water can freeze, causing ice-under-ice, which thickens the melting sea ice by adding to from below. The second type is called bottom ice, because it forms on the bottom of the sea and often rises to the surface "...in some years at the beginning of winter, ships found themselves surrounded by ice which had suddenly risen from the bottom of the sea, this was proved by sand and bottom objects that had floated up with the ice." (17).

But this is away from the subject of young ice because these types of ice do not require any special techniques in order to cope with them. During the winter ice hunting season the Eskimos along this coast encounter young ice almost every time they travel out onto the sea ice. There are three places in which young ice, called by the general term sikuliak, is usually encountered: in cracks, which can occur anywhere; on the "ice apron", which forms along the edge of open leads; and in the open leads themselves.

## The Ice Apron

When a lead opens offshore it may be kept open, from several hundred yards to several miles wide, for one day to several weeks' time. Along the initial edge of the lead there is usually a shear wall of ice through which the great crack was rent, so that travel by dog team or on foot is virtually impossible. The crack does not follow along smooth ice areas, but breaks through rough ice and even large piles, unless there are some unusually large expanses of smooth ice paralleling the coast. For the first several days after the ice breaks open, it is therefore difficult to hunt for seals because it is possible only to wait for them in one area rather than travelling along the edge to find the best places to hunt. However, almost immediately after the lead opens, an apron of ice begins to extend outward from the edge. It is this apron, or ateganegak, which serves as a smooth avenue for travel all along the lead edge.

The development of the ice apron is variable, depending upon the temperature, current, location and probably other factors as well. Sometimes the ice forms in excess of 20 yards outward during a single 24-hour period, and the thickness along the base of this new development is great enough to support a man or a dog team. This rapid development is especially likely to occur in "bays" along the ice edge, and the slowest development will be near points on "headlands". At other times the ice extends outward very slowly, such that only a few feet of thin ice forms in a night. Near the end of January there was a long period when ice apron growth at Wainwright was very slow, even though temperatures were well below 0° F. A possible explanation for this was seen in a parallel case at Point Hope in May, also with below zero temperatures. In this case there was an offshore current, i.e., a current moving away from the landward edge of the ice. Young ice extended approximately 20 to 25 feet outward during one 24-hour day on the landward side, but from the seaward side of the lead it developed out perhaps one-half mile.

The explanation for this phenomena is apparently the current, which carries slush ice away from the up-current edge and deposits it on the down-current edge, where it solidifies and forms an apron or field of young ice. During the cold winter months the far side of the lead is usually not visible due to steam fog, so this process is not observable. Since the Eskimos always hunt on the landward side of the lead, and the lead is kept open by an offshore current, this explains the fact that they speak of young ice "coming in" to close the lead. The extensive fields of young ice always grow outward from the down-current side, and when the current changes they are carried landward and close the lead.

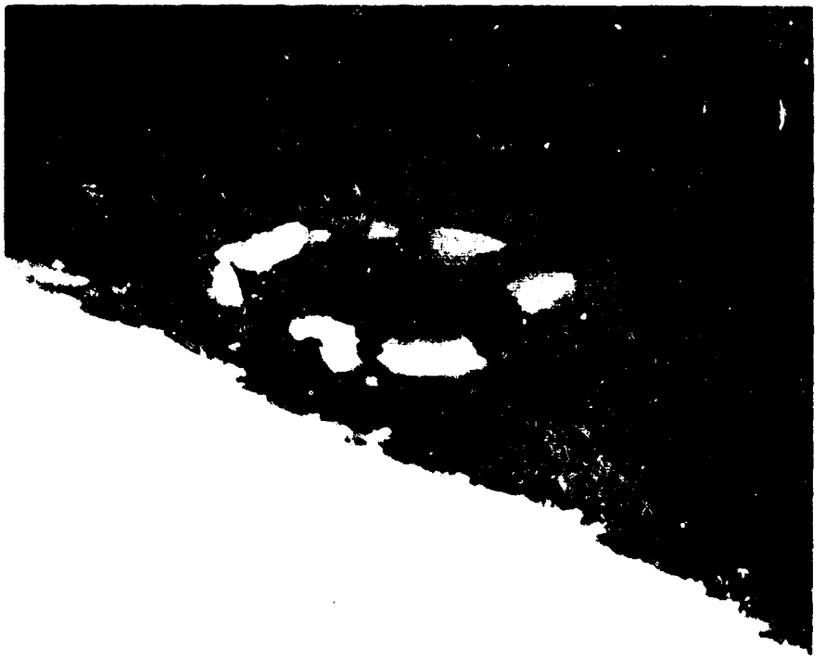
If the current more or less parallels the lead edge there is a more rapid development of the ice apron, and after several days of this type of current the ice usually closes over the lead completely. Normally, however, there is an offshore current as long as the lead is open, but the ice apron forms wide enough to travel on within two days. At this time the Eskimos travel to the edge by dog team, using a trail chopped early in the season through the rough ice, and they move along the edge of this natural roadway. At first they are careful to keep close to the heavy ice, and do not travel out far onto the ice apron, but as the apron thickens and extends up to 50 or 100 yards outward, the hunters travel farther out toward the water's edge in order to be closer to any seal which might surface.

The thickness of the ice is not uniform, but diminishes toward the edge, so that the hunter who walks out near to the water to retrieve a seal or help another man launch his small skin boat must know exactly how far out to go before the ice is too thin to support him. There are several ways to judge ice thickness and safety, as well as methods to prevent breaking through ice which would not normally hold a man. Young salt ice must be five or six inches thick before it will support a man or a dog sled with complete safety, but a lesser thickness of perhaps four inches will usually suffice for short periods of time. It has been mentioned also that salt ice will bend, and will in fact soak water up through the cracks thus created before giving way beneath a man's weight.

## Judging Young Ice Thickness

The most definitive characteristic of safe versus unsafe ice is its color. Although there are intermediate stages and rare exceptions, unsafe young ice is very dark in color, usually black. This coloration is caused by the fact that thin ice is saturated with water and also reveals the color of the water below. As the ice increases in thickness it begins to rise higher in the water, and therefore the color becomes gray (sikuliak maptizoak). Once this color transition takes place, the ice will support a man or a loaded dog sled. This color distinction is important especially when the Eskimo is travelling along on a dog sled, because the decision to cross an area of young ice or a crack must be made ahead of time, and there is no chance to use other methods of testing the ice without stopping. Not infrequently there are large areas of young ice along the lead edge, or especially when young ice drifts in and closes a lead, where most of the ice is safe but there are scattered areas of dark unsafe ice. It is possible even for a fairly inexperienced person to guide a dog team safely between the weak spots and over the narrowest places where unsafe ice must be crossed. With a dog team it is especially easy to move over unsafe ice because it will bend but not enough to break as the sled passes quickly over. Should

Very dark young ice, too thin to support a man, is sharply distinguishable from the safe grey ice beyond.



A hole caused by a ringed seal pushing its head through thin young ice to breathe. The circular arrangement of small ice chunks remains after the opening freezes over, leaving an indicator of the presence of seals.

an Eskimo find that he has gone out onto ice which is too thin, he would never stop the team, but would turn the dogs in a tight corner and without slowing down return to safer ice.

It is interesting that the ice within one field is not uniformly thick, so that one cannot plan to encounter ice which is everywhere safe or unsafe in a given area. Fortunately the color distinction is almost 100% effective, and the areas of weak and safe ice are usually defined by distinct and abrupt transitions. This phenomena is most noticeable along the ateganegak, or ice apron, where there are "lines of equal ice formation" resembling growth rings. These rings represent different stages of ice development, and may be from 1 to 10 feet apart. Why they form is not known to this writer, but he has watched an ice apron grow outward for some 25 feet, presumably at an even rate, and have several such lines in it.

Somewhere near the water's edge, from 5 to 30 feet away, there is a transition from safe to unsafe ice. This transition is almost always abrupt, and along one of these parallel lines. While he walks along the ice edge the Eskimo usually follows close to this line. In bays the lines are far apart, and around points they are close together, so it is necessary to watch fairly carefully and avoid attempting to cut across a bay rather than following the lines as they bend inward around the contour of the heavier ice forming the bay. At points one must walk closer to the heavy ice or in some cases move up onto it if the apron has not yet frozen safely. The lines of equal ice formation are therefore a helpful guide to the Eskimo as he walks or rides along this smooth young ice bordering leads.

It is worth noting here also that dogs will often be shy of unsafe ice, but not at all infallibly so. Their avoidance of thin ice is probably because of its wetness, which chills their feet. Sometimes it is difficult to get the lead dog onto the ice apron or other young ice areas even though the ice is safe, because of the moist surface. On other occasions the dogs will walk right out onto black young ice if not told by the driver to turn. The Eskimo who is travelling on young ice anywhere is continually alert, and indeed alertness is one of his most exceptionally developed aptitudes. When on foot it is easy to blunder out onto unsafe ice without realizing it until the ice begins to bend or break, especially if there is a seal or polar bear being stalked. On the dog sled it is easy for one's attention to wander away from the trail ahead. These could be fatal errors, and the Eskimo seldom allows them to happen.

Color is therefore an important and obvious distinction between safe and unsafe young ice. Fortunately the young ice does not normally become snow covered because snowfall is slight and infrequent, and the ice is so moist that the snow usually melts fairly rapidly on any questionable ice.

A second test for ice safety is that which involves the use of the unaaḳ, a wooden pole four to eight feet long with an iron hook at one end and a sharpened iron prod at the other. The unaaḳ is the most important piece of equipment carried by the sea ice traveller, and only the rifle is seen with greater frequency in use on the ice. Usually the pole is fairly slender, an inch to one and a half inches in diameter, and round in cross section. It can be made from any kind of wood. The iron prod is made from a variety of materials, such as screwdriver shafts, pieces of pipe sharpened and flattened at one end, large spikes, and various other miscellaneous types of iron rod which are available. This prod is usually inserted into a hole in the end of the pole, and a metal band is placed around the wood to prevent splitting. At the other end there is a sharp-pointed hook, with a shaft 3 to 10 inches long, inserted also into the wooden pole. Not infrequently the pole has been broken or split and has been repaired by splicing and binding with wire or thong. In former years the point was made from bone, and at the other end was a leather thong for hanging the pole on the wrist (2).

The method of using the unaaḳ for ice testing is as simple as the ice-color test. When the condition of the ice is questionable, the iron prod is given one firm thrust down into the ice. If it does not go completely through, the ice is safe; but if it breaks through it will not safely hold a man. The unaaḳ is therefore carried everywhere during hunting and walking on the ice, and is thrust into the ice every two or three steps if it is at all questionable. This test is much more reliable than the color test, because it is literally infallible and because of the fact that intermediate ice coloration does occur. There are also occasions when the ice is covered with snow, especially after a storm, where it can be blown over weak ice, and the unaaḳ is absolutely essential at such times.

The Eskimos warn repeatedly that the ice can be dangerous after heavy storms which cause much drifting snow. There are sometimes open holes or cracks, or areas of thin ice, which become covered with snow during the storm and remain unsafe afterward, covered with drifted snow. A crack with snow blown over it in this way is called ḳupaḳ aputilik. This takes place most often in the spring, but there is no reason why it could not occur at any time. Several of the Wainwright Eskimos mentioned that they had fallen through the ice because of this condition, and some mentioned having seen it where there was no ice at all beneath the snow, a condition called mafshak.

This type of condition was present at Wainwright during the early spring of 1965. From April 10th until the 12th there was a powerful south wind which raked the coast all the way from Point Hope up to Barrow, causing extensive flooding and cracking of the sea ice. Following this the

temperature ranged into the 20's during the day, but fell below zero at night. On the 19th the writer observed several areas where drifts from the storm covered fairly extensive areas of soft slushy ice, and in some cases there was a layer of water several inches deep between the young ice and the snow. Around these areas there were no surface indications whatever to warn of the dangerous conditions and it was discovered only because dogs and sleds sank deeply into the soft slush. On the following day, April 20, an Eskimo who was running behind his sled fell through in such a place, and fortunately was saved from a deep dunking because he was holding the upstanders of his sled.

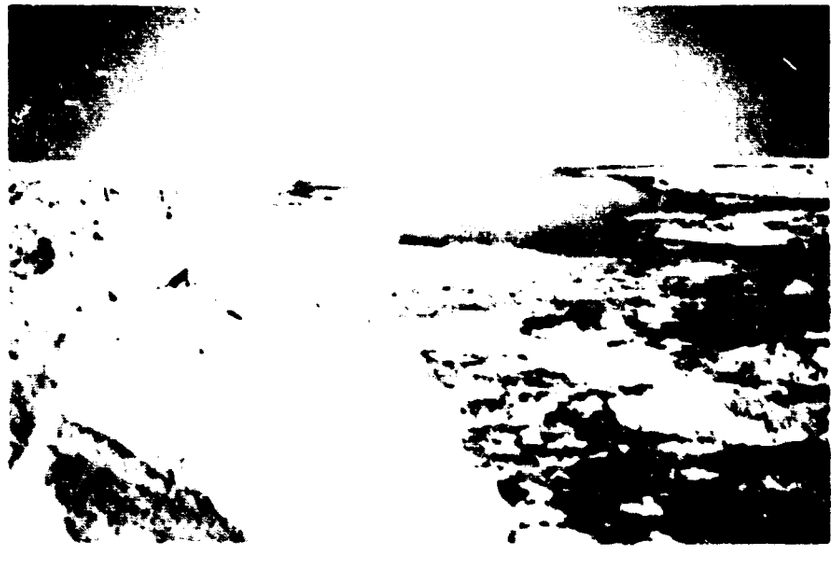
Another form of unsafe ice, which is perhaps best discussed here, is called "mush ice", a type of slushy ice caused by the grinding together of the edges of ice floes and ice pans. Whenever there is any parallel or shearing movement of great fields of ice, there are areas where the ice is ground and pulverized, sometimes filling the water with a heavy ice slush. This ice is called pogazak when it forms, and it later freezes into a solidified mass if the temperatures are cold enough. During the winter it is often found completely filling a frozen crack, from 6 inches to 15 feet across. This is called iginik. As long as it is frozen solid it is no danger to the ice traveller, and often forms a trail through rough ice areas, since cracks are easier to follow than clambering over the ice piles. This solidified slush is very bumpy, however, and it is easy to turn an ankle by walking on it. It is also very abrasive, so that it can wear through boot soles quickly.

During the late spring this slushy ice becomes dangerous because the warmer temperatures allow it to remain an unfrozen mass for days. Since it tends to thicken and eventually protrude six inches to a foot above water, it becomes fairly white and looks deceptively safe. Quite often, however, the color is distinctively darker than the surrounding solid ice or ice pans, so that even from a distance snow-covered solid ice shows up much whiter than slush. However, there is no real distinction colorwise between mush ice which has frozen solid and that which is unfrozen and soft. In this case the test is the same as is used for any doubtful ice -- one thrust of the unaak, or ice prod. If the thrust goes through the ice it is unsafe for a man's weight. This ice is especially dangerous should a man go through it, because it is so slushy that it bursts instantly and also affords no hand hold. It is said that when a man goes through mush ice, the hole fills up over him because the slush is so unconsolidated.

## Moving Over Thin Ice

More will be said regarding emergency procedures in case of falling through young ice, but first there are some notes on the methods of

A moving ice floe photographed from the edge of the landfast ice near Point Hope. Such floes are extensively broken near the edges, and became increasingly unconsolidated as the spring and summer progress.



An open spot along the lead edge near Point Hope. Considerable accumulations of unconsolidated mush ice are seen in the lower right, caused by moving floes grinding against the landfast ice.

avoiding such an accident. In actuality there are few occasions when Eskimos are forced to walk over dangerously thin ice nowadays, although apparently it was more commonly done in the old days when men travelled far out onto the ice even when it was in motion. The most probable situations demanding that a man walk over young ice would be: (1) during daily hunting trips where some walking onto young ice is required for retrieval of killed seals, (2) if one is forced to cross an area of weak ice in order to reach safer ice than that which he is already on (e.g., caught on a drifting ice floe), (3) if the traveller is not watching where he is walking or driving dogs, and goes out onto thin ice, (4) if the ice is snow covered so that the color is not visible, (5) in modern times, if a man is involved in an airplane crash or boat accident on the sea ice, and (6) if travelling in times of severe sensory deprivation, such as a windstorm, which an Eskimo would seldom do.

There is an old method of walking on young ice, by which a man can move over ice that normally would not support him. This method may, in fact, have been learned from the polar bear, which is said to be able to move over ice that even the most skillful Eskimo could not walk on. A story was told by one man of a White hunter who was searching for polar bear with his airplane. He figured, with disasterous results, that any ice strong enough to support a bulky polar bear would support his airplane. He attempted to land on black young ice on which a bear was walking, and crashed through it. When a bear comes to an area of thin ice that it wishes to cross, it simply spreads its legs wide, even until its belly touches the ice, and crawls along without stopping. The ice usually will not break beneath it.

This is the method by which men also move over thin ice, although for them the consequences of falling through are much more severe than for the aquatic polar bear. The method was demonstrated by several Wainwright men, although none would do so on the thin ice itself because it is not a common Eskimo philosophy to take unnecessary chances. In essence it consists of spreading the legs as widely as possible, while still retaining good coordination, and sliding them along quickly and evenly without lifting them from the ice. The vital principle is to keep moving and never stop the fast and even pace until attaining safe ice again. It is also advised not to look down, but to keep looking a few feet ahead to avoid becoming panicked. If one has walked out onto thin ice by accident, it is probably best to turn back quickly, having turned a tight corner and spread the legs widely as soon as the ice is felt bending underfoot. It would obviously be too dangerous to stop and turn back, hence the idea of turning a corner.

If the ice is too thin to walk over on foot, the imitation of the polar bear is carried further by getting down on all fours and crawling along with arms

and legs again spread widely. And, this failing, there is no choice but to lie flat on the ice, arms and legs stretched out, and squirm along (8). One Eskimo said that when he was walking over young ice and felt the ice give beneath one foot he would throw himself prone, as gently as possible under the circumstances, and roll for safety. Such methods are strictly for emergency because sea ice is so very wet that it would not be worth soaking the clothing if better means of crossing the thin ice could be found.

Young ice always has on its surface a wet and salty layer, even if the temperature is minus 30° and the ice is several weeks old, and even if there is a thin snow cover. Of course this condition varies according to these factors, but the Eskimos seldom sit on any sea ice without some sort of protection. This wetness is especially important to those who hunt seals along the ice apron, because this ice usually is devoid of snow cover, and is relatively newly formed. In old times there was a flap of loonskin or other waterproof skin carried by hand or tied around the waist so that whenever a man sat down he was protected from the wetness by sitting on the skin. Men today are less careful about this, often sitting down to shoot without any protection for the clothing, but some use pieces of caribou skin, gun cases, or sit on the dog sled. This moisture which soaks up from the ice is called masahok.

Returning to the subject of walking over young ice, it is interesting to note the amount of individual variation of proficiency in this skill. Young hunters, particularly in former times, "followed" the older and especially the more expert hunters out, and learned the sea ice skills by watching and listening to them. There were some men who were most expert at walking on young ice, and it was best to learn this skill from them. Today some men are able to walk on young ice fairly well, while some cannot do it at all. One 60-year-old man who is an especially good hunter, but is six feet tall and fairly heavy, said that he can walk over ice about "three inches" thick, but that some can move over ice "half" that thickness. A 24-year-old man said that he could stay up on "two inches" of ice, but that a 43-year-old man who was present at the time could walk on even thinner ice. And this man said that his father could do even better than he.

These estimations of ice thickness are probably quite accurate, since they were given by reliable and astute individuals. The weight of the individual is important, of course, and so is his age. In this case the older men generally excell the younger ones because they have learned properly, and have practiced the skill. The 24-year-old man mentioned above is exceptionally coordinated and is a skilled hunter, and his ability in walking over young ice probably exceeds all men his age in Wainwright. Many men openly admit that they are not good at this skill, and most say that their fathers and grandfathers were quite expert at it.

The story is told and retold of an old man who lived at Wainwright but was from Point Hope, and who was the expert-of-experts at walking on thin ice. They say that this man once shot at a seal that had poked its head up through the thin young ice to breathe. He missed the seal and wanted to see where his bullet struck the young ice, so he walked out and went to the place where the seal came up. He could not stop, of course, but walked around the hole, checking for the bullet marks at the same time, and walked safely back to the solid ice. The ice was so thin that the front of his foot broke through with each step, and yet he could still stay on top.

There are several items of equipment which are an aid to walking on thin ice. Most frequently today there is need for support on the ice near the edge of the ice apron. For retrieving seals a small open skin boat (umiahalurak) or kayak (kayak) is used, and in order to launch the boat it must be pushed to the edge of the young ice. The hunter spreads both legs widely, supporting his arms on the boat from the rear or, in the case of the kayak, the middle. Thus he has a tripod effect, by which he can push the boat onto ice so thin that the boat breaks through and floats in the water as soon as he climbs into it or even before, depending upon how quickly the ice at the edge tapers off. The small boat is also used to stand in near the edge of the ice apron, if a seal is to be snagged with the manak, or retrieval hook, or if it is pulled up with the hook on the end of the unaak.

The unaak itself is important for support on young ice, besides simply testing for thickness. At the edge of the ice apron it is laid flat and one foot is planted on it, to spread the weight more widely while the hunter is retrieving a seal. The unaak can also be used to give a tripod effect, with the legs spread wide and the unaak used as a third point of support. Around Bering Strait during the 19th century there was a stout wooden "ice staff" with a bone point, and above the point a hoop of antler or bone, exactly like the hoops on the bottom of a modern ski pole. This increased the efficiency of the tripod effect by covering a larger surface area after the point was thrust through the thin ice.

Stefansson recommends the use of skiis or snowshoes for crossing young ice, and states that skiis are the best equipment for this. The Alaskan Eskimos, from Bering Strait north to Point Barrow, traditionally used crude snowshoes for walking on the young ice or on the tundra (2). These snowshoes were only about two feet long in this northern region, and had a rudely-made oblong frame. The webbing was made with widely-spaced leather thong. By Murdock's time (1881-1883) this old type, described earlier by Simpson (19) (1853-1855), had disappeared and been replaced by the Indian type. Evidently the use of snowshoes underwent a revolution in Barrow at the turn of the century, becoming much more popular than in former times, but now snowshoes have all but disappeared.

A few pairs, which were probably obtained through the National Guard, were seen in Wainwright and Point Hope, but only once were any snowshoes seen being used. This instance was the old man Tiŋuk, at Point Hope, who used a very old pair that he had gotten from a Diomede Islander. Tiŋuk is a very old man in his 80's, who used snowshoes for walking over the soft deep snow in May. These snowshoes were built according to the old pattern.

## Falling through Thin Ice: Emergency Procedures

In spite of the skill of the Eskimo in recognizing dangerous ice and in moving over it if necessary, there are accidents every winter in which men fall through the ice. Probably every man who has done much hunting and travelling on the ice has fallen through at least once, but never during the study was a story heard of a man falling through and dying as a consequence. In the past, and to a lesser extent today, the Eskimos went out onto the ice prepared for emergency -- i.e., they dressed properly and carried whatever gear would be necessary if they drifted away or fell through the ice.

Many men told of their own experiences of falling through the ice, although perhaps a few cases in which they had not been alert or had made a foolish error were conveniently forgotten. Some of these stories follow:

One Wainwright man in his 40's had fallen through the ice three times during the winter season, all on young ice. In the first case he was crawling out onto thin ice to hook a killed seal with his unaak, and fell through. He swam to solid ice and crawled back up onto it. Another time he was walking over some thin ice and felt himself sinking through. He threw his rifle to solid ice and again swam to safety. This illustrates the important principle of throwing the rifle onto solid ice. The rifle is the Eskimo's most important tool, and he always has the presence of mind to save it first. In the third case this man was carrying a kayak over young ice, perhaps to the edge of the ice apron, with another man. He fell through and quickly grabbed the kayak, and the other man pulled him to safety by grabbing the other end of it. This brings to mind the possibility of men being tied together or carrying a rope while walking over large areas of uncertain ice, but nothing was ever mentioned of such a practice.

An old man said that his worst experience of falling through the ice occurred in a place where thin ice was concealed by a snowdrift. He tried to climb up out of the water but his rifle, slung horizontally across his back, caught beneath the surrounding ice. He finally was able to remove the rifle from the carrying case and throw it up onto the ice. Then he climbed up on the ice.

A young Wainwright Eskimo was once driving his dog team about "six miles" out on the sea ice. It was during the spring, at which time cracks tend to become covered with snow without any ice having formed beneath them. His dogs broke through the snow-cover over a crack, but were able to keep moving and reach the other side, pulling the sled along. The front part of the sled crossed safely, but the dogs then stopped and began to shake off the water, and the rear end of the sled went down into the water. The man was soaked to his armpits, and he turned and headed for shore, running alongside the sled most of the way to keep warm.

Running or walking alongside the sled is commonly mentioned as a way to keep warm after falling through the ice. This illustrates also the fact that many men, either because they cannot get a change of clothing or because they are close to home, head quickly for the village. One man who fell through and had considerable difficulty climbing back up onto solid ice was able to borrow a pair of dry pants but was forced to walk and run "eight miles" to Wainwright. It is easy to become thoroughly soaked by falling through the ice, because if there is thin ice all around or a high steep edge up onto the solid ice it may be very difficult to get out of the water. For this reason ideally a hunting knife is carried on a belt tied outside the parka, where it can be grabbed and used to grip the solid ice or even to chip hand- or foot-holds into it. If there is thin ice all around, one must break the ice as he swims, by smashing it with his arms. Van Valin (20) writes of falling through the ice and following his Eskimo companion's example by rotating one forearm around the other to break the ice while moving along to a spot thick enough to climb up.

It is a fortunate man who is near to other hunters when he falls through the ice, because he can depend upon them to help him when they hear his shouts. The factor of group safety is important in many Eskimo hunting practices on the ice, where usually the men stay fairly close together, but yet far enough apart to have a good chance for game. There is a long-standing tradition of hunting partners which still exists today, where two men habitually hunt and travel together for mutual protection and assistance.

In the case of assistance for a man who falls through the ice, there are three things which can be done after he is out of the water. First, other men can share their clothing either by lending extras which some hunters usually carry in case of emergency, or by taking off articles of clothing being worn at the time and giving them to the wet man. Second, they can supply shelter in the form of a windbreak or tent, and other materials such as caribou skins, which they may be carrying. Third, and of much importance, one of them may be carrying a gasoline stove, and with the help of some sort of shelter the wet clothing can be dried. Some men, especially

those who carry open skin boats on their sled for seal hunting, will take plenty of extra gear in the form of clothing, stove, canvas, etc., for their own use or to help others in case of emergency. The small skin boat can also be used for a shelter, turned up on its edge and with caribou skins or canvas hung over the open side.

Kusik told a story of falling through the ice which went roughly like this: Once he fell through the ice when it was new in the fall. He swam to solid ice and got up onto it, but found that there was no dry snow, which he could have rolled around in to blot the moisture from his clothing. Powdery snow, especially at cold temperatures, is the best material for drying the clothing if it is available. He took his dogs quickly to shore and found some snow there to roll in but it did little good because he had already squeezed out as much water as he could and the rest had frozen already. He said that he had regretted being alone because had he been with another man they could have divided up that man's clothes and gone home, but as it was he had to go home wet and very cold. It was noted also that in the fall and winter the water itself is "warm", but in the spring it is very cold. However, the air temperature difference between these seasons would probably make it much safer to become soaked in the spring, especially since there is good sunlight at that time.

Finally, there is the important matter of clothing, of which some types are far better than others in case of immersion in the icy water. A Wainwright Eskimo related how he fell into a crack which was covered by snow and had difficulty getting out because the edges of it were fairly high above the water. Since he had been in the water for several minutes, he said that he was most fortunate to have been wearing skin boots, pants, and parka because the skin prevented him from being soaked. Unlike cloth, skin is fairly waterproof and, especially if sewn with sinew, will not allow much water seepage. Clothing made with caribou fur is also naturally buoyant, and will support a man in the water.

Cloth, on the other hand, soaks up water quickly, weighting the wearer down. It also cannot be dried by rolling in the snow like fur clothing can. It is said that if the caribou fur is dried out by rolling in the snow, and perhaps squeezing moisture out of the fur by running the hands down through it, there is no need to go home early from hunting. In the case of skin boots, such as ugurulik<u>s</u>, there is always a drawstring tied around the boot top above the calf. This string normally is used to keep snow from entering the boot, but in case of falling through the ice it keeps the feet dry. Extra boots are, however, an important item to carry if extra clothing is taken along on the ice, because if water is squeezed downward out of the clothing as it should be, the boots may become soaked inside.

VII

# WINTER SEA ICE

## Types of Winter Ice

For the purposes of this paper, there will be only two main types of ice: The first, young ice, has already been discussed and is most important to the Eskimo because of the problems involved with moving over it safely. The second, winter ice, includes all types of sea ice which are thick enough to preclude any danger of breakage under the weight of a man or dog sled. Under the young ice section there were two main types considered, black young ice and gray young ice, which are differentiated here mainly because one type is safe and the other is unsafe. Both types share in common such qualities as wetness of the surface and usually are not rafted or hummocked enough to deter travel over them. Winter ice is also subdivided into two groupings, winter ice (ice-of-the-year) and polar ice (old ice). While both types are not liable to breakage beneath the weight of a man or sled, they are continually susceptible to movement due to wind and current, such that an intimate knowledge of local and seasonal ice conditions, wind and current forecasting, and the dynamics of ice movement must be acquired by the Eskimo ice hunter.

From the Eskimo standpoint all ice of one season's growth or less is sikuliaq, or young ice. However after it exceeds about a foot in thickness, it is called sikuliagezoaq, or "thick young ice". And when it is piled and rafted in any way, it is no longer considered young ice. There is perhaps no general term equivalent to winter ice or ice-of-the-year, but rather a whole series of terms for particular ice formations, such as piled ice, rafted ice, flat ice areas, landfast ice, and so on. Old ice, on the other hand, is recognized as a distinctive ice type, called pakaliaq, but this ice apparently occurs only along the northern portion of northwest Alaska, and is not often seen by the Point Hopers. The conclusion of this writer is that once the ice is so thick that there is no chance of it breaking beneath any weight of man or loaded sled there is no longer much concern with the age of the ice, but rather the morphology of it is important -- factors such as ice piles, cracks, and flat areas.

Winter ice which is not rafted or piled achieves a thickness of perhaps 10 feet during the cold season, but wherever the ice is disturbed it increases its thickness. It is open to conjecture how great the thickness of the ice becomes when there are ice piles up to 60 feet high and large areas of ice which are piled 5 to 15 feet high above the surface. It is certain that beneath these piles the ice extends very deep indeed, bearing in mind the fact that more of the ice is below the surface than above it. Along the coast

between Point Hope and Point Barrow the ice is very mobile, and therefore it is almost everywhere an expanse of piled and jumbled ice floes which consolidates solidly during the entire winter season except for the frequent cracking and opening of leads. Only in the deeper bays and indentations or the small areas protected by points does the ice remain unmoved all winter. Along the coast from Barrow to Barter Island the ice is much more stable, however, making this province more akin to the Canadian Archipelago, where flat ice is also common.

Whether it lies in motionless flat plains or in piled ice fields, winter ice is always discernable from polar ice. Polar ice is that type of sea ice which was not melted in the previous summer(s) and is therefore one year or more old. Winter ice is always much different in appearance from polar ice because unlike the latter it is either very flat or very jagged. Flat winter ice is punctuated only with the minor undulations of snowdrifts, and is always completely snow-covered before the spring thaw. And wherever there are ice piles, the type of relief is one of extreme ruggedness because there has been no weathering. Winter ice is broken up into huge chunks piled at random against one another, or it may be crushed into small blocks piled high into the air; and sometimes there are layers of ice which have rafted or slid one on top of the other.

Unlike either flat or piled winter ice, polar ice has gone through a season of weathering due to warm temperatures, and has therefore a more or less gently undulating surface. The hummocks and piles of ice have acquired the character of rounded knolls, and between the scattered knolls there are either flat areas or shallow depressions. Only around the edges of polar ice cakes or along cracks through it is there any of the jagged roughness of winter ice, and in such places the difference between the two types is also apparent. Whereas winter ice breaks up into small chunks or flat slabs, not usually over three or four feet thick, polar ice breaks into colossal chunks, some standing 30 feet above the surrounding ice, resembling icy monoliths. And when polar ice cracks it forms yawning fissures 8 to 15 feet deep, much different from winter ice cracks, which are frozen over almost level with the surface unless they open through ice piles.

Polar ice is also different from winter ice in that it is not completely snow covered, but has scattered (or sometimes frequent) areas of glare ice. The wetness of winter ice does not permit it to be blown snow free, and there are never any bare spots on the level surface until the spring thaw. Polar ice not only has these round bare spots, but also has a snow cover with a sort of hard crunchy texture, and often a snow crust, quite different from the snow on winter ice.

Finally there is the important difference that polar ice is fresh -- it does not contain enough salt to be detectable by taste. During the summer thawing, the salt percolates downward out of the sea ice, and thus by the following fall it becomes fresh. This change causes polar ice to be quite different in coloration. Winter ice is a grayish or very light turquois color and has a milky appearance. Polar ice is a deeper greenish-blue color, or a very dark blue if it is over two seasons old, and has a shiny glare on its surface. It is also not moist or sticky for sled runners as is the ice-of-the-year. Being fresh, polar ice splinters and is brittle, lacking the elasticity and resilience of salt ice.

It should be noted that these distinctions are important to sea ice travel and survival, because the two types of ice have characteristics which make them behave differently under pressure or which make one or the other preferable for an ice camp. The fact that polar ice is an easy source of fresh water is the most obvious of these, but this will be dealt with in detail later. As mentioned previously, polar ice or pakaliak does not occur all along the northwest Alaska coast, nor will it be present at all seasons. At Point Hope it seems that this type of ice appears only sporadically, a few small pans or floes being seen frequently, however. At Wainwright, on the other hand, this heavy ice is commonly seen every winter. During the 1964-65 season, polar ice appeared at Wainwright in late February and early March, first as a few scattered pans several hundred square yards in size, and later becoming more common and increasing in size to floes up to a mile long. The Eskimos say that this ice comes down from the north at this season each year but in variable amounts.

During 1964-65 the polar ice was exceptionally common, such that in March there was more of this than winter ice beyond 5 or 10 miles from shore. This was considered to be an indicator of a more solid freeze-up than normal, and was said to be the cause of an unusually small amount of ice movement after the beginning of March. There were few open leads at Wainwright after this time, and those that did open were much farther out from the shore than normal. It was said by the natives that the ice had frozen solidly clear across to Siberia and this was the reason that the ice moved so reluctantly.

There are two types of ice which are found in the ocean besides that which is formed directly from the salt water itself. The most commonly known is glacier ice, which forms icebergs. Icebergs are not found in this region of the Arctic because there are no glaciers to calve them anywhere along the Alaskan Arctic coast. The other type is also fresh ice, that which freezes in the sea outside the mouths of great rivers such as the Colville or Mackenzie. This type is assumed not to occur along the coast between Point Hope and Point Barrow, or if it does it must be quite rare.

It should be found along the section east of Barrow, however, and was seen off Barter Island by the writer during April 1965. This ice was smooth, unlike polar ice, but was blown free of snow to expose its brownish coloration, and when tasted it proved to be quite fresh. River-produced ice is likely to be found anywhere around the vicinity of these large rivers, and may be moved quite large distances along with the ice pack, as is evidenced by Stefansson's finding it a hundred miles from shore (21).

## Landfast Ice

The Eskimo does most of his sea ice travelling and hunting close to the coast, usually not going far beyond the edge of the tuwak, or landfast ice. Landfast ice is that winter ice which is driven against the coast before a fall or early winter gale, causing it to pile so high and so deep that it becomes solidly anchored to the bottom. This ice is therefore held solidly throughout the winter, and only the ice beyond the flaw or edge of the landfast ice moves with the wind and current. It is at the flaw that leads open up, or somewhat beyond it if some ice has fastened itself solidly to the edge of the landfast ice (tuwagatigut siku). The extent of the tuwak out from shore depends upon the depth of the water and varies seasonably according to the strength of the storms that crush it against the coast.

Wainwright is located in a shallow bight, and the water offshore does not drop off quickly. The landfast ice usually extends for one to several miles, building itself outward as the winter passes. South of Point Hope the landfast ice is not nearly as large an area because the water drops off more rapidly. At Cape Lisburne, near Point Hope, and Nelson Head, on Banks Island, the deep water comes right up to the land so that there is never any landfast ice. In these places the ice can be broken off right at land's edge, without even an "ice foot" or small projecting ice fringe hugging the cliffs. Generally, however, there is landfast ice extending out for one to several miles throughout the Arctic coasts (8). The landfast ice extends to fairly great depths everywhere along the northwest Alaskan coast, perhaps down to 60 feet or more. Stefansson records landfast ice extending down 120 feet at Banks Island, where it is piled by strong west winds with high tides, and grounds solidly in spring and summer when there are east and southeast winds with low tides. The amount of wind and current, as well as the range of the tides, must also determine how much of the ice can remain grounded and resist being carried away.

The landfast ice is normally composed of winter ice, although polar ice and river ice can be consolidated into it, if there is any in the area so early in the season. At Wainwright during the season of 1964-65, the landfast ice was notably whiter and more dirty than the ice which later piled up

against it from the ice floes. There was a beautiful turquoise hue seen in the crevices and crannies of most winter ice, but this was not detectable in the landfast ice. Whatever the cause for this, it was never explained by the Eskimos, and it is not known if this is typical of landfast ice. If it were, this dirty whitish ice would be an excellent indicator to the ice traveller of whether or not he was close to land, but perhaps this was just a peculiar occurrence of "bottom ice" which became grounded.

It is difficult to say just where the ice is landfast and where it is not, until leads have formed and closed several times. The best test of how solidly the ice is grounded is a powerful storm from a direction which normally would blow the ice away and form a lead. The Wainwright Eskimos could not say whether or not the ice which came ashore on November 22, 1964 was landfast until it had been tested in this way and proven to be solidly grounded. As mentioned above, most ice hunting done by contemporary Eskimos is carried out on the landfast ice or on the ice which is held solidly to it. There is usually no need to go farther because leads open up somewhere close to the grounded ice, and occasionally right along the seaward side of the large piles that extend to the bottom.

This is exceptional, however, and usually the lead opens somewhere on the ice which is attached to the tuwak but is not grounded itself. Since this ice is not usually held strongly enough to resist breaking away in a storm wind, or especially a south wind with high tide, the hunters are always watching the current and weather closely if they go out more than a mile beyond the solidly grounded ice. Only when there is an onshore wind which will not change soon, and a favorable current, do the men travel far out onto the ice to hunt bears.

## Effects of Wind and Current on Ice Movement

It is at these times, and whenever the men are at the lead edge somewhere beyond the landfast ice that the weather, current, and ice condition must be studied carefully. Quite frequently the decision whether or not the ice is absolutely safe for hunting is made from the shore before venturing out. In his prediction of ice conditions and possibility of breakaway of the ice, the Eskimo is exceedingly careful. He will not take any chance of drifting out on the ice and being unable to cross the lead to return to land. To him there is nothing that warrants taking a chance. The most highly prized game, a large polar bear, would be, and often has been, passed up in order to avoid such a risk. There are a series of observations which the Eskimo makes as standard procedure before ever going out onto the ice, and several additional ones that he makes while on the ice itself, by which he can judge quite well the conditions for ice hunting. Since all of

these observations relate to ice movement, and particularly to movement beyond the edge of the landfast ice, they can be of importance to a man on either side of the lead, i. e. to a man who is hunting on the landfast ice or to a man who has been caught on the other side of the lead and must survive until the ice closes over it.

Around settlements such as Point Barrow and Point Hope the ice can be broken away, and leads or cracks form with only the force of the current. In more sheltered places such as Wainwright the current is not so strong, and usually current and wind both are necessary to move the heavy winter ice. Between November and May the wind is the dominating influence upon ice movement along this coast, because it controls the current. Thus the current flows from the north when there is a north wind, from the east with an east wind, and so on. Later on in the spring the current is less dependent upon the wind, so it no longer prevails from the north but is mostly from the south.

The coastline at Wainwright trends NNE-SSW, and forms a long concave curve from Icy Cape to Point Belcher. Wainwright is 15 miles south of Point Belcher and about 50 miles north of Icy Cape, and is located 7 miles inside a straight line drawn between these two points. Therefore a wind which blows from the NNE, causing ice movements parallel to the shore, would theoretically cause shear (parallel) ice movement approximately 7 to 10 miles offshore from Wainwright, because the ice is said to break even with the headlands and points.

Keeping in mind the trend of the coastline, and assuming that the current is running in the same direction as the wind is blowing, the following assumptions can be made: A northeast wind, the most common direction of winter storms, blows almost offshore and usually causes ice movement which opens cracks and leads. This is one of the most dangerous winds for ice travel or hunting, because it can easily break off the ice along a lead or form a new lead, carrying away anyone who happens to be out on the ice. However, for the seal hunter this is the most favorable wind because it opens the lead, and when it continues to blow at a moderate or light speed it keeps the lead open. An easterly wind will usually do the same thing to the ice, but wind from this direction is not as common as from the northeast.

A moderate southeast wind usually is accompanied by a south (southwest?) current, which holds the ice solidly against the tuwak, but a powerful southeast gale, especially in the spring, can open wide leads. It is considered a very dangerous wind for ice travel, and hunters will hurry toward the land when the southeast wind begins to blow. It is often said that, unlike any other wind, the southeaster can blow away the landfast ice

right up to the land because of the high tides which accompany it and lift the grounded ice piles free of the bottom. Winds from the south and southwest do not normally carry the ice away or even cause parallel ice movement near Wainwright. This is evidently due to the accompanying current holding the ice in toward the land. At Icy Cape, however, the south wind (including southeast) "always" causes the ice to move out and opens leads offshore.

The west and southwest winds push the ice solidly in toward the land, and when they are strong the ice is heaved, piled, and rafted. These are the winds for polar bear hunters, allowing them to travel with impunity 20 or 30 miles out from the land, even if the wind is a soft breeze. It is preferable that the wind be blowing about 10 to 15 mph, however, because a strong wind is too cold and may cause ice piling, and light wind is more subject to shifting to another direction. Should the latter happen, the traveller far out from the landfast ice would head for the land as quickly as possible unless he ascertained that there was a fairly strong onshore current. If the wind is very light from the west or southwest, a hunter will try to test the current before travelling out far from the grounded ice, because the current will often shift before the wind. Thus he might find a slow northeast current, and he would not go out beyond safe ice.

The wind virtually never blows from the northwest during the sea ice hunting time, but there are occasionally north winds, sometimes reaching storm velocities. The north wind does not open the ice at Wainwright because it is more or less parallel to the coast and somewhat onshore. North and east winds lower the tide and ground the landfast ice solidly.

There are many differences between the sea ice conditions at Wainwright and those at Point Hope, and this is mostly due to the different geographical situation of the two villages. Unlike Wainwright, Point Hope is located on a long point jutting 15 miles out beyond the surrounding land, and it is also located at the most seaward end of a huge headland or promontory, with Kotzebue Sound to the south, the Chukchi Sea to the west, and the Arctic Ocean to the north. Therefore the winds, which blow with greater force here, and the currents, swirling powerfully around the end of this huge obstruction, move the ice much more easily and rapidly than at Wainwright. This is demonstrated by the fact that leads can open up right from the beach, carrying away whatever landfast ice there might be.

Point Hope, the long triangular sand spit upon which the village of Point Hope is located, protrudes out from the land in a westerly direction. It is located along a stretch of coastline between Cape Thompson to the south and Cape Lisburne to the north. All three of these headlands are characterized by extensive and frequent ice movement.

Around Point Hope, leads and cracks open up when the wind blows from any quarter except the west, because the land faces three directions instead of one. Like Wainwright, the best wind for opening the ice is the northeast, not only because storms frequently blow from this direction but also because deep water off the south side of the spit prevents the development of extensive landfast ice. East winds have a similar effect, but do not break the ice off so close to the land, and also tend to open the lead off the west end of the spit rather than the favored south shore. The northeast wind can open leads less than 400 yards offshore, a situation almost unheard of at Wainwright. Southeast and south winds open leads off the north side of the spit, and sometimes the high tide lifts the landfast ice and it is also blown offshore. During April 1965 a terrific south wind moved the ice out about a dozen feet from the north shore, but it was too heavily grounded to move farther. The same storm created huge ice piles off the south side of the spit and, although they were not believed to be grounded, these piles were said to be so "heavy" that they prevented the lead from breaking open any closer than about five miles off the south shore. This forced the people to do their spring whaling at a lead west of the point, which was contrary to their usual practice and which forced them to whale several miles out.

The Point Hopers are considered fortunate because the leads for whaling and sealing are usually very close to the land compared to the other Eskimo villages to the north and south. Point Barrow also has frequent leads opening offshore and these are usually fairly close in, but the situation here is not so favorable as at Point Hope. The Wainwright men must travel several miles, and sometimes 10 or more miles, to go seal hunting, and have been known to do their whaling at leads 20 miles from shore. Sometimes a crew will even travel as far south as Icy Cape or north to Point Belcher to take advantage of better leads and greater abundance of whales. This habit of travelling far out onto the sea ice makes them in some ways more prone to be cast adrift, although the ice here moves more sluggishly than around the points. At Point Hope the ice moves easily, but the men are never more than a few miles from shore, and usually less than one mile. In 1964 the Point Hope whalers were disappointed that they had to go three miles out to whale. The Wainwright men went about 12 miles during the same season.

From the "lay of the land" it is therefore possible to predict, even by examining a map, what the ice conditions at any particular locality will be. The winds which blow offshore will open leads and move the ice out, parallel ice movement, and onshore winds hold the ice onshore or cause it to crush and pile. It is of course necessary to know the peculiarities of each type of wind, the tide, the conformation of the bottom, and the current conditions in order to effectively make detailed forecasts regarding the

probability of ice movement and lead formation. Only the Eskimos at each settlement have accumulated this detailed knowledge.

It is important to know what the effects of the current are on ice movement, and to test the current whenever possible, because it can aid the wind, nullify its effect, or move the ice without any wind being present. At Point Hope on May 7, 1964, for example, there was a 20 mph wind from the north, which caused the floes along the north-south oriented lead to move parallel to the landfast ice. On May 8 the lead opened as the north wind died down, because there had been a somewhat offshore current but the wind had kept the ice moving in along the lead edge.

Whenever there is a current it effects ice movement, and it may or may not overrule the force of the wind. At Wainwright the people usually blamed an onshore current for holding the ice if there was an offshore gale which failed to open any lead. If there are cracks in the ice which parallel the shore, so that the ice could be blown away easily by an offshore breeze, the current can hold the ice in against the wind or carry it away in the absence of any wind. Current cannot be predicted reliably from shore in the winter, so it is necessary to go out onto the ice and test it. Of course, there are tendencies for the current to run certain ways, as in winter it usually goes with the wind. And in late spring and throughout the summer the current is from the south.

However, if the hunter is going out to a lead or far out in pursuit of polar bears, and he is in any doubt, he tests the current. Should he come to a crack over a few inches wide, he will test the current there, by taking a bright object that will sink slowly and dropping it into the water. As it sinks it falls straight down until it clears the lower edge of the ice, and then the current carries it off in one direction. By noting this direction, and whether it is going onshore, offshore, or parallel to the shore, the hunter can gauge the ice safely. In a crack such as this, or holes through the ice, it is preferred to use a piece of white seal thong from the skin boots, chewing it first to soak it thoroughly, for a current tester. Any piece of string or cloth, properly soaked so that it will sink, will do. Other objects such as an empty rifle cartridge, pieces of shiny metal, paper, etc. would also work as long as they do not sink too rapidly.

Usually the hunter does not test the current until he reaches the edge of the lead. When there is open water in the lead it is simple to test the current by throwing chunks of ice into it and observing their direction of drift, as long as the wind is not so brisk that it blows the ice chunk more strongly than the current moves it. Small pieces of ice that float low in the water are best for this. Of course it is also possible to observe the direction of the current simply from the direction of movement of the ice

in an open lead if there is not a wind pushing it along. Thus in one case the ice on the seaward side of a lead was moving directly outward and on this basis it was decided to return to the landfast ice because it was feared that several cracks seen on the way out to the lead would open and strand the hunters on a drifting ice floe.

One caution is advised whenever testing the current, especially with the method of dropping light colored objects down into a crack or hole. If there is a large pile of ice nearby it is possible that the current is being deflected or blocked by the ice protruding down into the water, giving a false indication of prevailing current direction. Whenever there is any doubt the Eskimo will test the current in a different spot for comparison.

During the summer and late spring months there are loose and unconsolidated floes, consisting of ice pans and chunks of varying size. At this time the current is checked by watching the movement of the largest pieces of ice, those which resemble icebergs but are actually formed by consolidation of ice piles into a huge mass. These pieces often move faster than the smaller ones, and if there is a wind they are less affected by it. Their direction of movement is usually the best indicator of current.

Generally speaking the current runs with the wind in winter, so that the effects of the two are combined and it only requires a knowledge of the geography of the area to predict ice movements with a given wind. In the late spring and summer the current runs from the south under any wind condition. Before a storm, especially one from the south, the current may run against the wind for a while, and its effect may be strong enough to move or hold the ice against light winds. However, if the wind is fairly strong, perhaps 20 mph or over, it takes precedence over the strongest current in its effect on moving or holding the ice. In other cases, where there is little wind, the current alone can move the ice if it is flowing strongly offshore or parallel to shore. This is most common around points, where the current is very powerful and there is less landfast ice. These concepts are general, but specific forecasts depend upon the conditions at the moment, especially upon the relative strength of wind and current as well as upon the particular direction of each. The Eskimos have developed the ability to forecast ice movements on the basis of their knowledge of the peculiarities of each type of wind and each flow of the current, so that for any combination of the two they can make a reliable prediction. This type of knowledge is difficult to obtain, especially without a full understanding of the Eskimo language and many years of actual experience with these phenomena.

## Cracks and Leads

There are several other methods of forecasting the movements of the ice and judging the safety of the ice for travel and hunting. Many of these have to do with cracks in the ice, their direction, occurrence, and movement. To the Eskimo any crack is a prospective lead--a lead which could trap him on a drifting ice floe from which he might never return. Cracks form in the sea ice due to several forces -- the rising and falling of tides, concussion from moving ice, the pressure of wind and current--and perhaps due to temperature. To the Eskimo the cause is important, because it helps him to predict what movement will take place along the crack, but the present conditions of wind, tide, current, and ice movement are what really determines this. Wherever there is a crack there is a line of weakness through the ice, whether the ice is freshly opened or covered with a week's development of young ice.

Of course the Eskimo is more concerned with a crack or series of cracks if they are very fresh, because then it is likely that the force which caused the initial movement or opening is still operating on the ice. Also the frequency of cracks is considered, and the more cracks there are, the greater the danger of shifting or extensive ice movement. Along toward spring, from late March until the ice breaks up, there are more and more cracks in the sea ice. This is not an indicator that the ice is more prone to open up leads than earlier in the year, although perhaps there is this tendency. Perhaps there appear to be more cracks because those which do form are kept open longer, by warm temperatures and sunshine, and are less likely to become snow covered.

After he finds a fresh crack, or in some cases it need not be less than a few days old, the Eskimo first observes the direction in which it is oriented. If the crack, or cracks, is oriented more or less at a right angle to the coast it is a sign that the ice is safe for travel, and will not easily break away from the landfast ice. However, if the cracks are somewhat parallel to the trend of the coastline, such as NNE-SSW at Wainwright or NE-SW off the south shore of Point Hope, the ice could easily float away under the influence of an offshore wind and/or current. The reasoning is simply that cracks paralleling the shore have severed the bond of the floe ice with the landfast ice, and are free to be moved away from it. Thus a crack paralleling the coast is never crossed if there is an offshore wind or current, or a possibility that one might arise while the man is on the seaward side. It is preferred that there be a breeze and current that will hold the ice in toward the land.

Cracks are said to go in the same direction as the wind (and probably the current) because the ice moves with them, resulting in shear or

parallel movement. It seems logical therefore, that the wind or current which produces cracks does not always cause them to open, but may give rise to shear movement as well. It is sometimes possible to forecast the direction of a wind which has not yet begun to blow by observing the trend of the cracks, and this is probably due to the current changing to the same direction and beginning to flow before the wind blows in that particular area. Thus a north wind would cause cracks to form in a north-south direction before it arose, and would probably cause shear movement along these cracks. A north or east wind that arose after such cracks were formed, could easily open the cracks and create offshore leads.

The "behavior" of cracks is a good indicator of the danger of movement or opening taking place along them. Cracks which are subject to being moved are not quiet, but pulsate or move slightly as a warning that strong pressures are being exerted on the ice. A crack which has a thin but complete cover of ice is probably "dead", but if the young ice that has formed in it has a small crack with open water down the middle, the crack is still moving, though it may be too slow and slight to be seen. Often a crack with open water in it cannot be seen moving except when a small stick is placed across it and watched for a while. If the ice moves, the stick may fall, may be moved to a different angle by shear action, or could be broken. Shear action is also indicated by looking for places where there is a small jutting out of the ice or the snow on top of it and a corresponding indentation on the opposite side of the crack. If the protrusion and concavity are not directly across from each other and the crack is fresh, it shows recent shear movement.

But the movement of cracks is not always slow, and may even be rapid. Thus the pulsating of a crack may be a quick jiggling, and parallel movements may be rapid jerks. Pulsating may be due to piling of the ice somewhere in the distance, or it may indicate that pressure is being exerted on the ice to open the crack. In this case the current would be tested and the wind direction considered before crossing to the seaward side of the crack. Cracks that show any motion whatever are taken very seriously by the Eskimo, because at any minute they may begin to move. At times cracks will close with such rapidity that water is forced up out of them in a spray, or they may open equally fast.

Nowadays the Eskimos rarely cross over a crack onto moving ice, although in former times it was done routinely as long as the movement was parallel to the shore and to the landfast ice. Thornton (1) describes the Wales Eskimos' method of hunting on the moving ice, where they continually walked against the current during their hunting activity in order to remain close to the spot where they walked across onto the moving ice. Modern Eskimos, with highly efficient hunting methods using rifles and

large mobile dog teams, do not need to take such risks to bring in a sufficient amount of game. If they ever do cross a crack that may be dangerous they are certain to carry a small skin boat with which they can return to safe ice, and to keep a constant watch for steam fog rising behind them to show a crack opening.

There are several methods which the Eskimo can use for crossing a crack or lead that opens between him and the landfast ice. The most basic and least advisable method is simply to swim across, which is done only as a desperation measure and when the crack has not opened very wide. Naḳaaḳ said that he had crossed cracks several times by this method, once swimming two cracks before reaching safe ice. In this case his five dogs swam across behind him and he rode his sled back to Wainwright, which was many miles away when this occurred. This man was very proud of his ability to swim.

The story is told of another Wainwright man who was also caught on the wrong side of a crack near the Kuk River inlet. He took his manak, a game-retrieving float with a long line attached to it, and threw it to the other side, catching it on some projecting ice. He attached another line to his waist, and tied the other end to the lead dog of his team. The manak line was used to pull himself across the lead in the water, and once across he pulled his dogs and sled to the safe side with the other line. Sled dogs are usually very reluctant to enter the water and can usually be forced to enter the water only if this type of line is used. Since a dog team is an exceedingly valuable possession, a man would hesitate to leave it behind under even these circumstances.

The fact that men are willing to swim across leads illustrates how strongly they fear being forced to spend a period of days or weeks out on the drift ice. Fortunately they seldom must use such an undesirable method for reaching safety. One man told a story of his own experience, which illustrates a commonly mentioned technique of crossing open water. He first warned that a man should never cross any fresh crack that runs parallel to the shore, because "If you do, you are giving your life away." Once he went far out onto the ice from Wainwright, and made the mistake of crossing such a crack on the way out. As he came in he found a new crack, but it was at a right angle to the shore. Taking this as a warning he began to run, but he was not in time to reach the fresh crack, which he had seen on the way out over the young ice, before it had opened so wide that he could not jump over it. He looked up and down the crack quickly, because speed was essential now, and spotted a small piece of ice less than two feet in diameter. He picked it up out of the water, threw his rifle and hunting bag across the water, and then took the ice chunk and tossed it to the middle of the crack. Keeping his unaaḳ (ice tester) as a balancing

pole, he jumped across the crack, using the ice chunk for a stepping-stone in the middle. That piece of ice saved his life, he related, because that lead opened very wide and did not close for two weeks.

If larger ice cakes are available the hunter uses them as a boat for himself and even for his dog team. A piece may be seen floating loose in the crack, or could be chopped with the unaak from the ice along the edge. This ice pan can be paddled over the lead with the unaak or the stock of a rifle, or the manak can be thrown across the lead and caught on the ice, so that the man pulls himself over by the line. Should the ice pan be too small to hold man and dogs both, a line could be fastened to the lead dog and then the team would be pulled from the opposite side. This illustrates another reason why the unaak is such a valuable implement of the sea ice hunter.

There are some hunters who always carry with them a small skin boat which they use to retrieve seals they have shot in the open lead (see section on seal hunting). These small open boats and skin kayaks are carried on the dog sled, so that they are always handy for use and easy to take out on the ice, and in former years were pulled out with a hand sled. If a man should find himself on the far side of a lead he can always cross it in his boat, unless he has the open type and the water is very rough. The kayak has the disadvantage that if there are two or more hunters they cannot all get into it, whereas the open skin boat can hold several men or one man with several of his dogs and most of his equipment. This is one reason why these open skin boats have become so popular along this coast. At Wainwright, whaling crews have been caught on the far side of leads several times, and the men have always returned to safety by using the large skin umiaks which they always have in whaling camps for chasing whales.

But there are also methods of "crossing" cracks without even leaving the solid ice, excluding the method of waiting for the lead to close in due time. The first of these involves a simple knowledge of the dynamics of crack and lead formation: When the ice begins to open, it opens first in the direction from which the current (and probably wind) is coming. Therefore if an Eskimo comes to a crack which has opened behind him, he will immediately toss a piece of ice into the water to see the direction of the current, and will then go as rapidly as possible down current. By so doing he hopes to reach the place where the crack has not yet opened or is narrow enough for him to cross. If the current (and/or wind) is from the north, he will go south, or vice versa.

There is a second advantage of travelling down current or downwind in such an emergency when it occurs along a coast with a headland to the north and/or south. At Wainwright, for example, the ice moving more or

less parallel to the shore will often be touching landfast ice, or even piling, at Icy Cape to the south or at Atanik (or Point Belcher) to the north. If the ice opens and is moving southward, a man who is caught on it may elect to travel in the direction of movement, hoping to get to landfast ice near Icy Cape. From Point Barrow a man would not travel north because there is no land in that direction, but if the ice were moving south he could hope to find escape around Point Franklin.

One more method of crossing leads is by finding a place where there is an ice bridge, i. e. where there is still contact across the lead by a solid ice pan or peninsula. Quite often there are heavy points of ice (nuwuk) which jut out into a lead, and drifting ice will contact them first when it comes in, last when it moves out. A Wainwright hunter narrowly escaped from a drifting floe in this way on February 6, 1965. The weather conditions, with a northeasterly wind at about 10 mph, did not appear to forewarn of ice breakup, but the barometer was falling and the tide was rising, which cracked the ice parallel to the shore. This man was the only hunter to go out onto the ice, because the other men were afraid of the ice conditions, but he went out because he was employed as a postmaster at Wainwright and had less chance than the others to hunt.

Travelling several miles out from the village, he found an open lead, where he waited for seals to come up. After a short time he had a "feeling" that he should head in for the grounded ice. As he approached the edge of the landfast ice, where there had been an open lead less than a week before, he came onto a crack which was opening rapidly. When he crossed this crack it was only about two feet wide, but soon after he passed it it was several yards across. He thought that he was safely onto ice which was firmly attached to the landfast ice, but soon he came to a small lead which he could not cross. He was in the bad position of being caught between two opening cracks with his dog team. He stopped and listened carefully, hoping to detect the sound of ice piling and crunching against the landfast ice, since movement was not only outward but also parallel to the edge of the solid ice.

He was fortunate enough to hear the sound of ice piling to the south of him and he turned his team as quickly as possible in the direction of the squeaking and crumbling noises. He found that the moving ice was still contacting a long point of very heavy ice which was solidly grounded, and was piling up along one side of it. This large point was visible from a considerable distance, and would have undoubtedly seemed a logical place for the last contact of the drifting ice. This man crossed to the landfast ice just before contact was separated, and had he not moved rapidly and been alert he might have been adrift until the lead closed.

In this case the ice which broke away was a large section between an open lead and the landfast ice. This occurrence is not uncommon, where a large floe breaks free from the landfast ice, and the phenomenon is called tuwayagatigut siku. The extent of the ice which remains attached when a lead opens varies according to the strength of the wind and current, the tide, thickness of the ice, and existence of cracks or weak areas. The original lead may open right along the landfast ice, there may be ice left in bays or areas protected from movement by projecting points, or there may be up to several miles of ice which projects far outward from the solidly grounded ice. It is these large expanses of ice which are most susceptible to breakage.

When a lead opens it is not usually a single cracking of the ice, which opens wider and wider until a large opening exists. The cracking is much more complex, and the opening may become larger and larger as new fields or pans of ice which are separated by cracks from the flaw (landfast) ice are carried out into the lead. Before a lead opens there is probably rather extensive cracking which interlaces an area several miles wide and gradually certain cracks open to form a complex of lanes or leads. If the storm or current lasts for several days this fragmented ice area gradually becomes cleared out, the ice pans and floes accumulating along the seaward edge of the lead, and the landward side becoming a clean break without loose pans of ice along it. If the storm is brief, however, there may be cracks along the landward edge which are still fresh but have not yet been subjected to enough force to open them and move the loose ice across the lead.

It is this latter situation that can cause a hunter to be stranded on a small ice floe or pan while he is waiting for seals along a newly-formed lead. And the fact that the opening of leads off the coast is not due to a single crack explains why multiple crossings may be necessary to return to safe ice. This same process probably takes place when cracks and leads form far out from the coast.

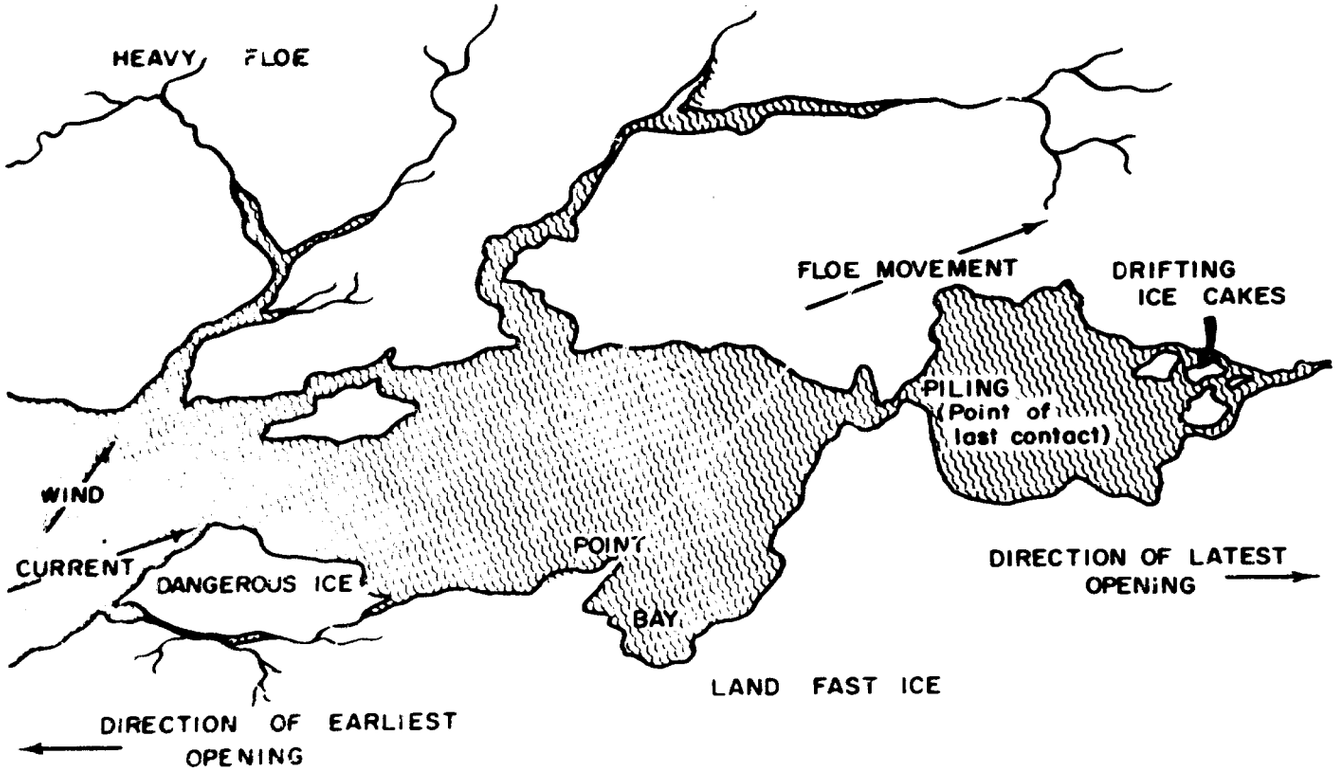
In some cases these loose ice floes are carried away by the current, which may flow strongly for several days following a storm. Even a light wind could eventually widen these cracks shortly after a storm. Eskimos do not often go to the lead edge immediately after a heavy blow, even though there are usually many seals at such a time, because of the dangers of being carried away on these loose pieces. Quite often it is said that there need not even be cracks present, because leads often have fairly large swells in them during a storm, and these swells continue after the wind dies down. These swells can crack the ice and allow it to drift away during the day following a storm.

There is another way in which large areas of ice can be broken off from the lead edge, and this can happen after a storm or any time that there is rapid ice movement parallel to the lead. During a severe gale the ice can be moving up to two miles per hour, and when such tremendous masses of ice are involved the impact force of the ice must exceed one's imagination. This movement usually continues for a couple of days after the storm subsides. If there is any contact between projecting areas of the landfast ice and the drifting floe, cracks can be opened which run for miles into both ice fields, and as a result some of the non-moving ice may be broken loose and set into motion with the pack.

Usually this involves rather small points or projections of ice, not over a square mile in area, but if there is any danger of this happening, such places are avoided by the Eskimo. If there are cracks present already, even if they are covered with young ice, they can create an even more dangerous situation. At Point Barrow in late February 1965, there was a large crack which was covered with ice thick enough to support a man, but which had moved several feet at least once as revealed by the fact that the young ice covering it was rafted, one layer having moved up and overlapped the other. This crack ran for miles parallel to the shore, and was about one-half mile shoreward from an open lead. The hunters would not cross this old crack to reach the lead because of the danger of a moving ice floe contacting this ice and carrying it away. At Point Hope, ice which is moving north or south off the end of the spit can break away sections of ice paralleling the shores of the land. If there is rapidly moving ice the men are cautious about going out to a lead north or south of the point, depending on which way the ice is moving, lest they be stranded on a floe which is knocked loose in this way.

An indicator of the force of this type of impact was seen at Wainwright, where there were several large cracks along the landfast ice over 10 miles from the offshore lead. These cracks, up to five feet wide, were said to have been caused by impact of heavy "mother ice" (atanan) somewhere out along the lead. There was no wind, tide, or strong current to cause the cracks. It was often said that ice moving someplace "far away" could cause cracking and opening simply by its impact and pressure.

Usually the impact which breaks off fields of ice is an almost deliberately slow process, one which does not cause a heavy jolt or make a loud noise. Thus it is difficult to detect this, or any other kind of ice breakaway. It is said that sometimes there is a slight jolt, but this is not likely to be felt. Whatever noise there may be will probably not carry more than a quarter of a mile, and of course many times the opening ice, and even parallel ice movement, is almost silent. The easiest noise of moving ice to detect is a sporadic squeaking sound, but this probably




**LEAD CHARACTERISTICS**

An aerial photograph of a lead which is beginning to open. Taken near Barrow, Alaska.

An aerial photograph of a lead as it is beginning to open, near Barrow, Alaska. This type of fracturing is apparently more common in this region than the simple fracture pictured above.

occurs only with young ice. This sound carries fairly well and is unmistakable when heard. There is also a hissing sound in some cases of parallel movement or slight piling. Only when the ice is really piling actively is the noise loud and rumbling. This sound was heard once from a half mile or more away, and it was very loud. When the piles grow to great heights there are great "boulders" of ice tumbling down their sides, sounding like a bowling ball slamming into the pins. On a calm day, with a strong current moving a huge floe majestically along a lead, this sound is strikingly powerful and curiously out of place.

A simple method of detecting whether or not one is on moving ice is to watch the current, and the motion of objects floating in the water. Normally there are small bits of ice moving by, and the current shows also in the water itself, but if this motion appears to stop rather suddenly so that now there seems to be no current, it indicates the floe is now moving along with the current. It is sometimes possible to watch the relationship of different conspicuous ice piles, and should they change it means that one body of ice is in motion relative to the other. Thus a hunter will watch the ice toward the village for any change, and will also note his position relative to the village or any landmark on shore Motion is also detectable in shallow waters by dropping a weighted line down to the bottom to see if it will be dragged along or will lie still.

One very clever method which is used today is that of placing a compass on the ice in a set position, so that any movement of the ice will probably show up as a slight movement of the needle off the position where it was set. One day at Point Hope there was a fairly strong southeast wind and the men in whaling camps along the lead were worried about the ice breaking away. In one of the camps a compass was set up to detect ice breakage. First a small wooden stool was placed carefully and solidly on the ice, and around it on the windward side were placed three snow blocks to protect it from any possible jiggling or movement by the wind. A compass was placed on the stool with the needle set precisely north and south, and for a while there were two compasses to be absolutely certain. Every 5 to 15 minutes a man would check the compass to see if the needle had moved at all from its exact setting. When the ice moves there is some rotary motion, so that this would be recorded by the compass needle.

Finally, there is a method of being warned by other Eskimos if the ice breaks away. If a man notices that a crack has formed and is beginning to open so that anyone across it would be in danger, he first shoots his rifle three times in rapid succession. This is the signal of long standing on the Arctic Coast to warn of breakaway of the ice. All of the hunters immediately head for the land when this signal is heard, and at the safe side of the dangerous crack or new lead they watch to see that no man is caught on

the far side. Should this happen they rescue him with a small skin boat, or they bring from the shore a umiak, or large skin boat, to conduct a rescue operation. If a man finds himself trapped by a lead he gives the same signal as a call for help, and marks his position by putting his cloth parka cover on his unaak pole and waving it as a signal of his location. The use of rifle signals and umiaks with outboard engines for rescue in modern times is one reason why so few men drift away on the ice as compared with former years. There is also a case at Wainwright when several whaling crews were set adrift without their knowing it, and they were warned by an airplane flying out from the village and dropping a note. Usually there is no chance to give a warning in this way, although there are numerous cases of airplane rescues from drifting ice floes.

## Piling Ice and Rough Ice

The dangers of sea ice hunting have to do mostly with being cast adrift as described above. But occasionally during normal travel or hunting activities, and certainly when a person does become stranded on an ice floe, there is the danger of actively piling and rafting ice. Almost everywhere over the thousands of square miles of sea ice in the polar oceans there are evidences of ice piling, in the form of ridges, hummocks, and huge piles of broken ice. The problem of dealing with rough ice and ice which is actively piling is therefore almost universal except in the most protected areas of bays and fjords. It is hardly necessary to say that ice which is moving in such a way is dangerous, mostly because of the huge chunks of ice which can tumble onto a person and the possibility of slipping into a crevice and having it close up, crushing whatever part of the person is inside. The physical problems of crossing actively piling ridges are so great as to render it nearly impossible, unless the action is very slow, and dogs are so frightened by it that they are very reluctant to get close to such areas.

Even going too close to piling ice, whether it is a small heap of young ice or a huge mountain of heavy polar ice, is extremely dangerous, because the flat ice close by can break, sink, or heave without warning. Whenever ice piles, the sheer weight of it causes downward buckling of the ice around it, which in turn causes flooding of the area. Any such flooding will soon become covered with young ice, but this young ice is not black at first like ice in the ocean itself. The whitish blue of the ice below causes this thin ice or slush to look deceptively safe, and it is easy to walk onto it without being aware that it is not safe. Such areas are also susceptible to being covered with snowdrifts, so any questionable ice around fresh piles or downward bucklings must be avoided.

When ice is piling and being forced together by great pressure, it is best to avoid flat areas of winter ice, especially if it is rather young. Once ice piles becomes solidified, a couple of days after formation, they are the safest place on the sea ice. Flat areas of winter ice can raft and pile suddenly, even before a man can escape them. It is not unusual to see a flat area where the ice almost began to pile but did not break, leaving a series of undulating "wrinkles" in the surface.

Once the piling of ice has ceased and the topography has solidified, there is the everpresent problem of travelling through the jumbled and jagged landscape. Along this coast the ice moves so frequently that long-distance travel is only done on the ice close to the beach, unlike those areas of the Canadian Archipelago or northeast Alaska where great flat expanses of ice offer the ideal highway for travel from place to place. Most of the sea-ice-covered regions offer these barriers to travel, as witnessed by the reports of many explorers who attempted to travel on it. One of the most recent attempts to travel over the ice to the pole was halted short because of the incredible roughness of the ice.

Anyone who has had the experience of a long day's travel by dog team through mile after mile of chaotically jumbled ice will not soon forget it, even long after the bruises have healed. Between the scattered pans of unbroken winter ice and the relatively flat polar ice, it is as though the horizontal dimension no longer exists. True, the huge piles can be avoided, but there is no trail which avoids the smaller jumbles of ice. One is continually being hauled abruptly to the top of three- or four-foot chunks, only to have the sled ed off sideways, tipped, hung, twisted, jammed, pinched, or simply crashed straight off an abrupt drop, with the driver stumbling behind or clinging to the upstanders. The arms and legs of the driver become rubbery-tired and tempers flare. The dog lines constantly snag on small pinnacles of ice, and the dogs run ahead as soon as the tangle is released, pulling the sled, driverless, over whatever lies ahead. It seems as though the sure-footed dogs take sadistic pleasure in reserving their bursts of speed for the roughest ice or for the times when their master has stumbled into a crevice but does not release his grip on the sled stands. Up once again, he looks ahead to a seemingly insurmountable pile of ice boulders, and shortly is pulled and pummeled through it. Each time it seems that the sled will surely break, and yet it holds. Each pile seems that it must be the last, and yet there is always another. And at least once on every trip across the floes, the sled slips down the side of an ice pile only to crash directly into a low flat wall of ice, which the dogs were agile enough to jump up onto but the sled runners cannot ride over.

Indeed even the dogs are stiff and bruised the day following such an excursion, but the Eskimos are apparently so accustomed to this that it is

scarcely worthy of comment. Occasionally an Eskimo will fall or in some way injure himself, but this is not common because he usually stays on the sled as much as possible to avoid slipping on the ice. Ankles, legs, and ribs are probably the most likely places to be injured during dog team or foot travel through rough ice. If a person has weak ankles susceptible to sprains, he is perhaps least suited for this. Only one injury was noted during 1964-65, and this was a severe leg bruise sustained by a man running to catch his sled. However, every man probably falls on rough ice once or twice every time he travels through it for any distance.

Certain individuals are much better at travelling through rough ice than are others, and for the most part this is the result of skillful reconnoitering. The expert traveller constantly stops his team and goes to the top of high ice piles to pick the smoothest trail, and once he has decided which way this would be he makes long detours and follows a winding path. On one occasion the writer travelled with two other teams for some 15 miles through very rough ice, and observed firsthand the difference in skills of two drivers. One man felt that he could do best by travelling a more or less straight line without stopping to reconnoiter. The other stopped every few hundred yards to find a smooth trail, and then proceeded to wind in and out of the ice until he was forced to stop again. The latter individual was continuously far ahead of the former, and returned to the village with all of his equipment in good condition. The man who followed a straight trail returned several hours later to the village with a badly broken sled and, undoubtedly, a very tired back. In rough ice travel it is also best to stop frequently to prevent excessive perspiration.

It is easy to lose track of directions in this sort of winding travel, so the Eskimo carefully picks out a landmark ahead of him in the direction of travel and then heads indirectly for it. By keeping track of these landmarks, and lining them up straight, the traveller need not deviate from the correct direction and lose proper orientation. This method of navigation could also be used for travel in poor visibility conditions, and would be of help to a man caught on the windward side of a lead, where the fog is thick, and during the mid-winter when it is always very dark.

Another problem of rough ice travel is the condition of the snow, which often accumulates in deep soft piles in areas of sharp relief. These drifts are especially dangerous because they conceal holes and crevices, into which a leg might slip or a man might fall. Drifts also tend to extend over the edge of abrupt drop-offs, so it is best to stay well back from any edge. At times the fluffy whiteness of this snow, especially in whiteout conditions, obliterates the sharp features of the ice "landscape", so that travel is very risky. Even sunglasses do little to relieve the strain of such conditions, where every effort is needed just to keep a good line of travel. Regardless

of the conditions, an Eskimo almost never is deterred as long as there is no danger of drifting away or being seriously injured. Eskimos are most persevering in their travel and hunting, and no expense of physical labor or time will deter an excellent hunter from reaching his objective or putting forth his best effort to get game which is within reach. And yet very seldom is effort expended by a good hunter if he feels there is no chance of success, as for instance the man who simply watches a seal that is a "certain" shot but probably could not be retrieved. At times there are attitudes such as these, or deviations from them, which strike the outsider as rather irrational or even foolish, but sometimes it is difficult to understand behavior whose context is not fully comprehended.

Occasionally the ice traveller is fortunate enough to find large areas of flat ice, kaiaksuakpok, which are oriented in the direction in which he wishes to travel. And when the ice is rough everywhere, there are sometimes small leads or cracks which have frozen over solidly enough to walk or drive a dog team along, and these cracks form a perfectly flat trail cutting through even the roughest ice. Cracks such as these are preferred by Eskimos in their travelling, and also attract seals because the thinner ice allows them to scratch breathing holes more easily. In midwinter, at minus 30° or 40° F, a lead freezes over solidly enough for travel in a day or so. In spring (e.g. April) it may be frozen over for a week and have ice 6 to 10 inches thick and still be too weak for travel, because young ice formed at higher temperatures is not as strong as that which develops in extreme cold.

It is possible that an ice traveller could estimate whether a crack or lead trending in one direction would continue on the same course for most of its length. This is because most of the cracks formed by a particular wind, along the coast at least, tend to run in the same direction. Thus if several cracks are crossed, all trending north-south, and then one is encountered which deviates from this pattern, it is probable that it is only a short crack or else the section is only a bend or crook in a crack which for most of its length trends the same direction as the others.

From the village to the edge of the landfast ice or the lead there is a trail chopped and smoothed by the Eskimos through all of the rough spots. This trail varies in length from 1 to 15 miles, but usually is chopped beyond the landfast ice only during the whaling season, when large skin boats are pulled out to the lead. During seal hunting the trail is necessary whenever large numbers of seals are taken, because the weight of a heavy load will break a sled in rough ice. The trail is leveled with axes, picks, and a commercially-made three-prong ice chopper. Several men can make a half mile of trail in three hours if the ice is not too rough, but at

Several hunters have followed this newly-frozen crack through the rough ice in the background. Areas such as this often have many breathing holes of ringed seals.

Dog sledding over some fairly smooth ice-of-the-year, near Wainwright, Alaska.

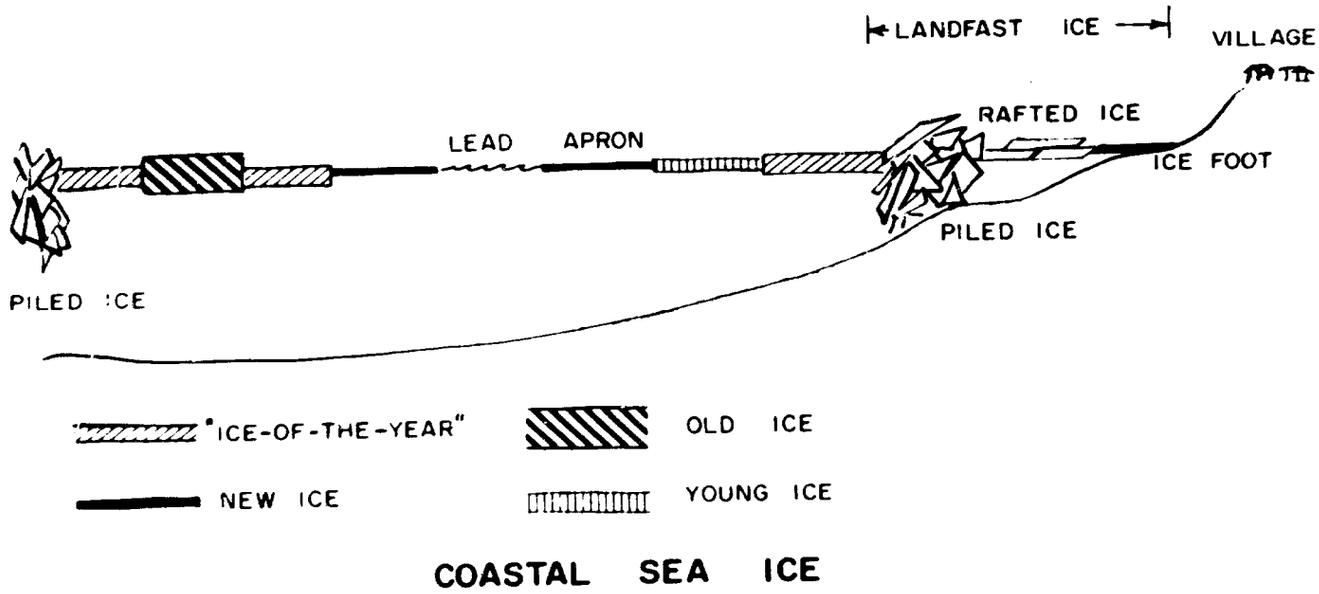
times it will take an hour to make 50 yards of trail which is smooth enough for the passage of loaded sleds. Care is taken to make the trail through the smoothest areas.

There are of course general patterns of ice piling along the northwest coast, so that in particular areas it is possible to predict that the ice will be smooth or that it will be very rough. This relates basically to the amount of ice movement and the direction in which it usually moves. In the vicinity of Wainwright there is fairly active ice piling, but along the coast for 5 or 10 miles north there is enough flat ice to permit easy travel close to shore. There may also be an "ice foot", which in this region consists of a smooth layer of ice bordering the beach, produced by the splashing and freezing of water on the shore in the fall. This ice, ranging from 5 to 50 feet across and about 3 feet above the ocean level, is used for travel along the coast in the fall, but becomes deeply buried by snow during the winter.

To the north of Wainwright, around Point Belcher and the old village of Atanik, the ice piles heavily due to a strong current, deep water, and outward projection of the land. Dog team travel on the ice here is seldom possible, but just to the north the sheltered ice of Peard Bay lies flat and undisturbed, making excellent dog travel during the ice season. In the opposite direction, beginning about 10 miles south of Wainwright and stretching to Icy Cape, the ice is also flat, being protected from movement by the Cape and the shoals offshore. All along the coast the long ice ridges tend to be oriented parallel to the coast and the edge of the landfast ice, but the smaller ice pilings are more or less randomly oriented, being produced by crushing around the edges of the circular ice pans. From the air the pattern of ice piling shows as an endless series of small flat areas with crumpled edges encircling each one. Along the edges of former leads and cracks, which are oriented parallel to the coast, the largest pilings are located, disrupting this circular pattern.

Murdoch (6) summarized the conditions of ice movement and piling at Point Barrow:

> Outside of the land-floe the ice is a broken pack, consisting of hummocks of fragmentary old and new ice, interspersed with comparatively level fields of the former. During the early part of the winter this pack is most of the time in motion, sometimes moving northeastward with the prevailing current and grinding along the edge of the barrier, sometimes moving off to sea before an off-shore wind... and again coming in with greater or less violence against the edges of this new ice, crushing and crumpling it up against the barrier...




**COASTAL SEA ICE**

The westerly gales of the later winter, however, bring in great quantities of ice, which, pressing against the land-floe, are pushed up into hummocks and ground firmly in deeper water, thus increasing the breadth of the fixed land-floe until the line of separation between the land-floe and the moving pack is 4 or 5 or sometimes even 8 miles from land. The hummocks of the land-floe show a tendency to arrange themselves in lines parallel to the shore, and if the pressure has not been too great there are often fields of ice of the season not over 4 feet thick between the ranges of hummocks, as was the case in the winter of 1881-82. In the following year, however, the pressure was so great that there were no such fields, and even the level ice inside the barrier was crushed into hummocks in many places.

...As the season advances, especially in July, the melting of the ice on the surface loosens portions of the land-floe, which float off and join the pack, bringing the leads nearer to the shore. In the meantime the level shore ice has been cut away from the beach by the warm water running down from the land and has grown 'rotten' and full of holes from the heat of the sun. By the time the outside ice has moved away so as to leave only the floes grounded on the bar the inside ice breaks up into loose masses, moving up and down with wind and current and ready to move off through the first break in the barrier...

Thawing Ice

At Point Barrow the ice breaks up "for good" around mid-July to mid-August, but the pack never moves far from land, and it may move in at any time during the open water season. At Wainwright the "final" departure of the ice takes place at about the same time, depending upon the conditions. In 1965 the breakup of landfast ice took place on July 6, but in 1964 there were several huge piles close to shore which held the ice until July 22.

At Point Hope the ice usually leaves sometime in June, except when a constant north wind holds it onto the north shore until perhaps the end of the month. Unlike Wainwright and Barrow there is no pack ice at Point Hope once it leaves in early summer, and this is important to the economy and ecology of the region because the walrus, bearded seal, and ringed seal follow the ice, and are therefore present at the northern villages and absent in Point Hope.

The transition from solid ice of the winter season to rotten ice and breakup is very rapid, such that the seasons of solid ice and of more or less open water take up most of the year, with only about a month for real thawing conditions. During the spring of 1965 the thaw at Point Hope did not begin until late May so that there was little opportunity to study thawing ice conditions during the period of field research. This was particularly true because the Eskimos are usually not predisposed to discuss subjects unless they are of immediate concern. Thus during a day or week when there is seal hunting activity going on, the men talk about sealing, not only the conditions at the time but general subjects relating to it. If there is no hunting going on, it is not usual to hear the men speaking about hunting. Thus when there was solid ice, and the thaw had not begun, little was said about methods of dealing with wet or rotten ice, and of course there was no chance to observe techniques which are used on it. Spring and summer sea ice is very different from winter ice, and deserves special study. The techniques of travelling on very wet and weakened ice are important, and the drifting ice pack of summer is an unconsolidated mass bearing little resemblance to the sea ice of winter.

During the spring the ice begins to thaw from above and below, the warm south currents eating away from underneath by the end of May, while the sun melts the snow into large puddles on the surface. Melt-water forms below the snow at first, so that the early thaw is not recognizable from the surface. Around late May and early June, at Point Hope, melt-water forms holes in the ice. At this time the ice becomes treacherous because there are many areas with thin ice concealed beneath the snow cover, and young ice is very slow to solidify. If a man falls through this ice it is usually very hard to come back up to the surface because the current is so strong in spring that it pulls the legs and body beneath the ice. It is very important to use the unaak to test the ice and snow ahead whenever there is any doubt. One Point Hope Eskimo said that when men become "lazy" and do not use the unaak continuously they are likely to fall through rotten ice.

Sea ice which has not become fresh is safer when it is thawing than fresh-water ice, because it does not honeycomb. Fresh-water ice, even when it is several feet thick, separates into long "needles" of ice which allow it to disintegrate easily beneath weights. These structures are also very sharp and can abrade the bottom of the dogs' feet or the soles of Eskimo boots. It is often necessary to make leather or cloth boots for the dogs in late spring to protect them from this ice. Ice at sea can freshen in spring and become honeycombed, or fresh polar ice or river ice may be encountered. The Eskimos always warn that polar ice melts more rapidly and breaks up more easily in spring than winter ice.

Although sea ice does not usually honeycomb as much as fresh ice, it may do so, in which case thick ice will give way beneath a man. If it does not freshen it is rather tough, such that a narrow bridge of ice only a foot wide and four inches thick will support a man's weight (8). The Eskimos warn that ice in summer is very treacherous, such as is found at Wainwright in July. Unsafe ice may or may not be dark in color, and if the ice is not black there is no method except the use of an ice tester to tell whether ice will support a man. With the unaak the "one-thrust test" is used, so that if the tester does not break through with one firm thrust the ice is considered safe.

Another phenomenon which occurs during the thaw is ice-under-ice, where puddles freeze over and have a layer of water below them and sea ice beneath the water. The danger of this is not great, except that the water could be deep enough to soak a man's legs if he fell through. It is probably impossible to tell at a glance if this ice is thick enough to support a man, since it is identical in color to the surrounding ice. The unaak, or ice tester, would be effective in judging the existence and safety of such ice. There may be no term for this in the Eskimo language, because the informant who was questioned about it called it sikukaŋana assi illa imekaġani, which means "ice on top and beneath it water."

Again, these are a few basic facts regarding safety on spring ice, but no pretext of completeness is intended. There are undoubtedly many techniques of dealing with this type of condition, and with the ice of the broken pack which exists in the Arctic seas from July through September. More study should be devoted to this subject, since it is an important aspect of the sea ice environment, even though it is present for a shorter period of time and is less available to the Eskimo for exploitation.

## VIII

## ESKIMO SEA ICE TERMINOLOGY

The Eskimos, being so much concerned with the sea ice, have elaborated their vocabulary relating to it. There are many separate terms dealing with the various types of ice and ice formations, some of which do not have equivalents in the English language. On several occasions these terms were collected, but the list which follows is certainly not complete. Definitions in quotes are derived from A functional glossary of sea ice terminology (18).

Ice Age or Thickness

Imaḳ: water.
Taġeok: salt water.
Teshak: salt water lagoon, lake.
Ugurugizaḳ: grease ice; the earliest stages of freezing, causes wind ripples to disappear from patches of the water surface.
Muwaḷlik: slush ice or ice rind; heavy development of grease ice, almost to the point of being nilas.
Isiġoaŋazuḳ: slush ice or ice rind, probably synonymous with the preceding term.
Pogazak: slush or mush ice formed by grinding of the edges of ice floes, pans, or cracks.
Mogazak: synonymous with preceding term.
Iginik: synonymous with preceding term except may be solidly frozen.
Migalik: pancake ice; "pieces of newly-formed ice usually between one and six feet in diameter. The raised rims and circular appearance are a result of the almost constant rotation and collision of cakes against one another."
Puktaḷhak: synonymous with preceding term.
Saloġak: nilas or black young ice; a thin, flexible sheet of newly-formed ice which will not support a man, is weak enough to enable seals to break through it with their head to breath, and breaks through with one firm thrust of the unaak.
Sikuliwzaḳ: synonymous with preceding term.
Sikuliaḳ maptizoaḳ: grey young ice; young ice which rides high enough in the water to be greyish color, and has become thick enough to support a man. Seals probably cannot break through any ice of this thickness, but often open breathing holes by scratching and gnawing. One firm thrust of the unaaḳ, or ice tester, will not break through ice of this thickness.
Sikuliagezoaḳ: heavy or thick young ice; according to the Eskimo informant this is ice about one foot thick.
Sikuliaḳ: young ice; general term includes all ice which is fairly new, up to perhaps one foot thick or more. This is the most frequently used sea ice term referring to newly-formed ice from the time it becomes a cohesive mass until it has piled or has become rather thick. It is a rather abstract term because it is used to refer to so wide a range of ice thickness.
Tokaviñeḳ siku: winter ice; probably refers to ice which is about five feet thick but is still in its first season of growth.
Utokaġaviñeḳ siku: "old ice"; probably refers to polar ice; ice which has not melted during one or more summers and has become fresh. This type of ice differs from winter ice in the topography of its surface, the dark blue coloration of the ice itself, the thickness

and height above the sea surface, and in its occurrence along the northwest Alaskan coast.

Paqaliaq: polar ice; probably synonymous with preceding term.

Atanan: "mother ice"; heavy floe ice; may be winter ice, polar ice,

## Various Conditions and States of Ice Movement

Aulalwichoq: no motion; the ice is not moving.

Igiliktaq: the ice is moving.

Sunmuktuqtuq: the ice is being carried away from the land.

Nunamuktuqtuq: the ice is coming in toward shore.

Tuwagatigut siku: the floe ice "comes ashore" and becomes attached to the landfast ice.

Tuwayagotigut siku: the floe ice breaks away from the landfast ice.

Siku sukumitkaksigaa: the sea ice is breaking up.

Kuvuloalinigaa tauna tuwakput: the landfast ice is breaking up.

Eyecheqtoq: opening crack.

Eyecheqtaktoq: a crack which is pulsating or is opening and closing.

Apuktaq: ice coming together or hitting together; probably referring mostly to the convergence of large floes.

Kaloagasitoq: the process of rafting, where one layer of ice is thrust over another forming two thicknesses of ice.

Ivuzuq: the process of ice piling.

Ivoaqsizuq: the condition of ice which is about to begin piling.

Ivaluqtaktoq: the noise of piling ice.

Agiaktoq: shear or parallel crack movement, such as would commonly be seen when an ice floe is drifting parallel to the edge of the landfast ice.

## Sea Ice Topography

Qupaq: crack in sea ice.

Qupagaluzaq: small crack in sea ice.

Qupakpak: large crack in sea ice.

Qupasuguzuq: synonymous with preceding term.

Qupagazoaq: synonymous with preceding term.

Nutaq qupaq: newly-formed crack.

Imak qupagazoaq: crack with open water in it.

Sikuichaq qupaq: crack without ice (with open water) in it.

Qupaq aputilik: crack with snow blown over it.

Putu: hole in ice.

Imaurak: small polynya or open spot in sea ice.

Imakpak: large polynya or open spot in sea ice.

Killigisiñek: shore lead; open water along the coast between the beach and the ice offshore.

Imaktinik: pressure crack which has folded or "buckled" downward and had the resultant basin filled with water.

Ivuuk: synonymous with preceding term.

Uiñek: shore lead; refers to the large open crack, between the landfast ice and pack ice, which may be from 50 yards to several miles wide.

Kanelluk: bay or bight along the lead edge; may also be used to refer to the water on either side of a point along the lead edge.

Nuwuk: point, either in the sea ice along the lead or on the land.

Tuwak: landfast ice; an expanse of ice which parallels the coast, extending outward for one-half mile to several miles, and is stationary due to large piles of ice within it having become grounded solidly on the bottom.

Kukuluginik: crack or pressure area where the ice has "buckled" upward to form a "roof" with open space beneath. The water beneath soon freezes, but such places are favored by seals for breathing holes, or if the formation is large, for dens where seals rest or give birth to young.

Tuhuzuginik: young ice which has been subjected to pressure and has "wrinkled" or formed undulations in its surface, leaving open spaces beneath. Also favored for seal breathing holes and dens.

Pikunik: synonymous with preceding term.

Kaigechuk: rough ice.

Kayagalaak: rough ice; probably refers to large areas with rough ice caused by crushing of the edges of ice pans and floes.

Sikukazaak: a piece or block of ice; probably refers to a large conspicuous piece.

Napaiuk: one large piece of ice which has been pushed up vertically to form a conspicuous landmark.

Ivunnik napaizoak: synonymous with preceding term but refers specifically to an unusually large vertical block, perhaps 20 to 30 feet high.

Napasalik: rough ice area which consists largely of pieces of ice which have been pushed into a vertical position.

Ivunnik: ice pile or ridge.

Ivunnikpaich: large ice pile(s) or ridge(s).

Ivunnigich: rough ice; implies an area with many ice piles.

Agayagnik: "file ice"; flat walls of ice, from 1 foot to 30 feet high, caused by ice piling followed by shear (parallel) movement along the ice pile. This creates a very steep vertical wall of ice which has obviously been planed off by abrasion of ice surfaces. May be an indication of the edge of landfast ice, because such parallel movement often takes place there.

Agaiupak: synonymous with preceding term.
Agaipak: synonymous with preceding term.
Agaiupakpak: an unusually large "file ice" wall, 10 or more feet high.
Agaiupaurak: a small "file ice" wall, less than two feet high.
Ivunnik ḳalligaich: areas where the ice has rafted; one layer of ice is thrust up over another.
Kalaġsinik: rafting of young ice which is too thin to support a man, but which becomes safe wherever it has rafted and doubled its thickness.
Ḳaiaḳsuak: flat area in sea ice; may be surrounded by rough ice, forming an "island" of flat ice, or may be a huge flat expanse; general term.
Ḳaiaḳsuakpak: a very large area of flat ice.
Ḳaiaḳsuzak: a small area of flat ice.
Ḳaimuguk: a flat "ice foot" along the beach, created by building up of ice from the splashing of storm waves. (Differs from the ice foot which is formed along cliffs in eastern Arctic.)
Ateġinegak: "ice apron" or fringe of young ice built out by freezing from the edge of open leads; important for travel while hunting because it is smooth.
Puktak: grounded floeberg; a large piece of floe ice which becomes stranded in shallow water, and may or may not be frozen into the sea ice in the fall.
Anagalu: ice which has sand, stones, and other bottom debris incorporated into it due to having been forced solidly into the bottom by ice piling and later being carried back to the surface.
Allivinik: ice which has been submerged and held below the surface for a period of time, because of ice movement, and later reached the surface again.

## Sea Ice and Its Movement

Kissuk: water sky; reflection of the dark color of open water in the clouds.
Puguzoak: "steam fog"; steam which rises from the water surface of cracks and leads in cold weather.
Iñipkagaa: white line resembling "steam fog" or low clouds in along the horizon, caused by refraction of the ice surface so that it appears above the horizon.
Kanik: frost crystals which form on young ice as soon as it begins to develop. Scattered frost crystals become more and more dense as the ice thickens until, on gray young ice, they completely cover the surface.
Masaṛlhok: moisture on young ice, which causes moist slush to form in footprints or sled tracks.

# IX

# DRIFT ICE EXPERIENCE AND SURVIVAL

## Drift Ice Experiences

The following section contains further notes on techniques of sea ice survival, specifically those which were used by individuals as precautionary measures in case they should drift away, or by men who actually did drift away and returned safely. In contemporary times there are very few of these accidents compared to the pre-contact period. There are probably few active ice hunters who have not come close to drifting away, but most of them are either rescued almost immediately or manage to find a way across the crack or lead in time to avoid being stranded.

Kusiq said that fewer men are cast adrift now because, first, they are very careful, and second, they are likely to be rescued by a boat which comes to their aid or be warned by someone shooting a rifle three times as a danger signal. Neaqoq, a Point Hope Eskimo, feels that the fact that men no longer have to stay out on the ice at night, as they used to do for seal netting, is the most important reason why so few men drift away nowadays. And there are also factors such as the decrease in general hunting activity, lack of necessity to "take chances" or to travel far out on the ice on foot to get game, and use of small skin boats for seal hunting, which can also be used to return to solid ice.

The most expert hunters are often the most active, and are therefore exposed to the risk of drifting off on the ice most frequently. However, these are usually the most cautious, alert, and intelligent men as well, and they are probably less likely to make mistakes. Several of the most successful hunters at Wainwright and Point Hope had never been caught on drifting ice except briefly, such that they were able to return almost immediately to the landfast ice. Kusiq drifted away only once, and was rescued, along with many other hunters, by an umiaq taken out from the village by men who reached safety in time. Ikaq and Qimizaq said that neither of them had drifted away because they had always "watched carefully." Neaqoq had many "close calls", but always managed to return to safe ice by crossing a crack on a bridge of ice or by running down-current until he found a narrow place. These men were all considered expert hunters.

It is, of course, important that Eskimos have traditionally been extremely cautious, and seldom face dangers if at all avoidable. Thus they do not take the risk of travelling out on the ice when there may be any chance of drifting away. Especially in modern times, with efficient

methods of hunting producing more game per unit of expended time and energy, there is no need to take risks. The possibility of shooting a few seals, or even killing a huge whale, is not justification for taking any risk of loss of life or of undergoing severe deprivation.

During the course of the field work many stories of being caught on the far side of cracks or leads were collected, but in most of these the men escaped by successfully crossing the open water in boats, on ice rafts, or by some other method. Three men escaped from the ice in a small skin boat when they were caught on a drifting floe off Wainwright in 1964. In this case the ice had been cracked by the tidal wave from the Good Friday earthquake which occurred near Anchorage. This cracking loosened the ice, and the floe was carried out by an offshore current, even though there was no wind at all.

Several years ago at Wainwright there were 22 men, 8 dog teams, and 3 umiaks set adrift on the ice about 15 miles offshore. In this case the ice had been broken by high tide preceding a south wind, and when the wind came up from the southeast it broke the ice away. The men were unaware of their plight until a missionary stationed at the village flew out with an airplane and dropped them a note. They began pulling the boats shoreward, through rough ice and across several open leads, the last one about a mile wide. This lead had to be crossed many times to get all of the men and their gear. It took 13 hours to get all men and equipment to safety, from the time they realized they were adrift.

In another instance a whaling crew of five men were set adrift south of Wainwright, also by a wind from the south quadrant. These men pulled their boat all night long, and finally stopped to camp when they thought they were on landfast ice. A short while later they realized that they were still adrift, when they set a compass on the ice and noticed that the needle was slowly shifting as the crack widened more rapidly to the south than to the north. They broke camp hastily, leaving much of their heavy gear behind, and headed for shore, crossing the lead to safety. Regardless of the size of the party it is best for all of the men to stay together, not only because this allows for mutual aid and the guidance of older and more experienced men, but also because once two parties separate on the sea ice they may never again be reunited due to fracturing of the ice floes.

It is more common for two or three men, sometimes one alone, to drift away. Many years ago two men drifted away on the ice from Point Barrow when a northeast wind came up while they were netting seals at night. They had with them a dog team, a Primus (kerosene) stove, and a kayak, but no tent. When they discovered that they were adrift they could have perhaps crossed to safety in the kayak, but they did not want to lose

their dogs. So they stayed out on the ice, using the seals which they had already taken in their nets for food, eating the meat raw so that the gasoline was burned only for making drinking water. Having no sleeping bags they "sat down" to sleep, perhaps using the sealskins for protection from the cold snow beneath them (informant was unclear about this). About two weeks later they reached shore at Atanik, 70 miles south of Barrow. A Wainwright man, Michael, was out polar bear hunting on the young ice, which was coming in and closing the lead, and was in most places thick enough to walk on. Michael spotted a dog team out on the young ice, and immediately began looking for places where the thin ice had rafted, making it solid enough for them to cross to the safe ice. At last the men made it safely onto the landfast ice after two weeks of drifting.

Amaoğak told of having drifted out on the ice with two other men and three dog teams, when a heavy storm broke and fragmented the ice. He wisely advised that they stay away from the lead edge, where the ice breaks into smaller and smaller pans, and that they go out instead to the heavy ice which does not break easily and is protected from the swell. Since they had planned to be out for only one night they ran out of gasoline quickly, but burned seal oil which they had and ate the food they were carrying with them. After four days the fragmented floes were again frozen together, the weather having calmed, and the men made it safely to shore. The zone of greatest motion, and consequent breakage of floes, is that which is within some 50 miles offshore, according to Stefansson. Beyond this distance there is less danger of the ice breaking up because there is no contact with the shore and the grounded ice. Drift ice survivors often report that they go out away from the land and the lead, but in this case they do so to find heavy ice and to get away from the swells, and they do not probably go out more than 15 or 20 miles.

Another problem is that of recrossing the lead when it becomes frozen over with young ice rather than closing by the heavy ice moving in to meet the landfast ice. Near Kotzebue two men once drifted away and were unable to regain the land for "about a month." They continually tried to cross the lead but were thwarted when the wind or current would again open the ice. These men remained alive by hunting seals in the open water, heating their snow shelters with seal oil. They finally crossed on the young ice and landed at Kivalina. Sometimes the men are not lucky enough to find seals, as these two did, and are forced to eat whatever skin or leather they may have, such as thongs made of sealskin. In other cases they have been forced to live without any food, which probably accounts for the numerous records of men having drifted away and never being heard from again.

A Barrow Eskimo said that he once was caught out on the ice alone, but was only forced to stay on it overnight. He had followed a polar bear far out onto the sea ice and shot it before dark, but the ice began to crack and move so much that he decided to stay in one place until it stopped. His father had often told him that whenever the ice traps a man on it, he must not hurry and move before it is really safe, because to do so increases the chance of falling through thin ice or being injured by trying to cross piling ice.

The same man told two other stories of drift ice survival which were illustrative of some of the important principles to be followed whenever one becomes trapped on the sea ice. These stories are written from the notes taken after he told them: Pete was born near the mouth of the Colville River in north Alaska, and the first story relates an incident which took place in this region, probably near Barter Island. He was out on a hunting excursion with several other men; the weather was perfect, with no wind blowing at all, good skies, and no current changes to create ice disturbance. Pete was just setting up to make tea and take a break when he heard a rumbling sound seaward from him. He watched in the direction of the roaring and detected grinding and tumbling sounds of ice breaking up; and yet the winds were calm. Suddenly he saw a great heaving of the ice in the distance, and noticed that it was being set into an undulating wave, breaking it into huge blocks moving up and down. He threw his gear onto the sled and tried to flee from the wave, but hardly moved before it hit the spot where he was. Wave after wave passed, while the other men made their way over the ice to him. They headed immediately outward, toward the heavy ice where they could camp on a solid enough place that it could not be broken up. They moved as rapidly as possible, so that they could find a good camping spot before the hundreds of cracks opened too wide to travel.

There were two young hunters along, who foolishly wanted to head for the edge of the lead which had opened, and await the chance to get onto the land. They were held back by the older men and stayed on the heavy ice, or they would surely have been killed by drowning. For the whole night the waves came, and the young men became seasick and frightened, but still they all remained on the solid ice. After four days the cakes froze together. With an older man leading, they carefully picked their way toward the shoreward edge of the ice, where they found a lead about 10 miles wide had opened between them and the shore. Here at the edge they camped, posting a constant watch as they had for the previous nights. The following day the ice began to move, under a favorable breeze toward the shore. They all went to the place where the ice curved out farthest toward the land, and were able to escape from it as soon as contact was made. They had, during the five days on the ice, eaten food from their supplies

and several seals which they killed. They found when they returned to their village that the waves had broken the ice all the way up to the shore. Pete thought that the waves must have been produced by an earthquake.

More will be said about safe places to set up camps on the sea ice, and some other basic factors of drift ice survival, after relating a second story which this man told: Pete one day took his aged father out onto the ice with him to hunt seals at open leads. On the ice they met two old men and two boys. They hunted all day in good weather, Pete getting three seals and the others getting one. When evening came he went to shore, but the rest stayed out on the ice to net seals. He took his dog team, leaving one team and a sled behind. The next morning he got up early and prepared to go out with another man to the lead. As they got ready the gut skin window on the top of the sod house began to flap, as a strong wind suddenly arose, and in a minute it had been torn completely off. They tried to go outside and were knocked down by the wind, so they could do nothing but wait for the gale to cease. They waited inside all day and the next night, and in the morning the wind had diminished. They could see by the water sky that the ice had broken away and blown completely out of sight. The temperature was bitterly cold now.

Pete travelled all over the coast, trying to hear whether his father had come into a village, but had no luck for perhaps a week or more. Then he heard that his father and another man had come ashore and were at a village. He went there immediately and found them to be in good condition, but they said that one more man was out on the ice. That man had been left behind because he had crushed his legs and pelvis when he tried to cross an actively growing ice pile with the dog team and sled. His foot had been pinned and a large piece of ice had tumbled onto him. The others were able to save some dogs and pull him from beneath the blocks of ice. The group of men had then headed out toward heavy ice to make a camp and build a snowhouse. The two boys took a dog and headed out for an attempt to reach the shore. Both of them were found later, frozen, having become lost and exhausted without any food. The three older men remained in the snowhouse, and were also without food, so the two able-bodied ones walked to shore as soon as the wind carried the ice back to the land, leaving the injured man in the snow shelter. Pete took one of the survivors out and they found the injured man still in the shelter after five days alone, foodless, and without any source of heat, still alive. His life was saved.

These two stories point out vividly the necessity to remain in one place until the storm subsides and the ice solidifies. They also illustrate the procedure of heading for heavy ice to make a camp. Both of these incidents occurred during the early part of the 20th century, before the Eskimos had given up wearing all-skin clothing and had become negligent about carrying

with them the proper gear in case of emergency regardless of how long they planned to stay out. Certainly the most cautious of the contemporary Eskimo ice hunters are the old men, who, whenever they go out wear the best clothing that they have and carry extra items of equipment which they would need only in an emergency. "The ice is like a mean dog," said one Eskimo, "he waits always for you to stop watching him and then he tries to catch you."

Although many of the modern Eskimos speak of going onto the ice prepared, in actual practice few of them do. A notable exception is Neakok, a Point Hope man who is an expert sea ice hunter. When he goes out hunting seals or bears, no matter how close to shore the lead may be or how safe the conditions appear, he usually carries a full compliment of emergency provisions: On the dog sled he carries his umiahalurak, or small open skin boat, so that he could cross a lead if necessary. Over his shoulder or in his "sled bag" he has a wolf-skin ammunition pouch, which measures about one and a half feet long and a foot high. In this pouch he places seven boxes of shells for his .243 caliber rifle and four for his .222 caliber rifle. Both rifles are always taken along. In the skin boat he places a gasoline stove small enough to fit in a two-pound coffee can, with plenty of fuel, extra lighter fluid, cigarettes, snuff, a compass, and a canvas tarpaulin. The sled has a caribou hide on it, to pad the boat bottom, and to serve as an emergency sleeping mattress. The tarp can be used to make a small tent, which can be heated by the stove while snow is melted for water. He usually carries a small amount of extra food along also.

If he drifted off on the ice he said that he would try to find a good solid place to camp, one where there is good snow for a shelter. He would stay away from the edge of the lead but would hunt seals at cracks or holes in the ice. Then he could wait for the ice to close, keeping watch on the wind, current, and stars, so that he could move enough to stay parallel with the village in case he should get a chance to cross to safety. Old-timers, he noted, would hunt with harpoons for seals at breathing holes, but often had to go without food or eat the seal-hide harpoon line. It was noted that a drift ice survivor can tell when he has reached the landfast ice because young ice which had formed in the lead will probably be moving onshore when he crosses it, and when it reaches solid ice it rafts downward beneath the ice edge, which it probably would not do if it were hitting against another moving floe.

## Sea Ice Encampments

Several times it has been mentioned that on drifting ice floes the Eskimos try to find heavy ice for a camp, to be sure that the ice will not break

up beneath them. This is a basic essential of sea ice survival, but one which even Stefansson does not consider in any detail in his works except to say that one must find "heavy ice" in order to make a safe camp. What is heavy ice and how is it identified? Heavy ice means, first of all, thick ice. The thicker it is, the less apt it will be to crack or pile up when pressure is applied to it. The thickest ice is obviously to be found where it has been piled up, which increases the vertical dimension to 30 to 50 feet or more. Even the largest ice piles, once movement has ceased, are solidified into a unified mass, such that the pieces making them up do not lie in the pile loosely, but have become firmly fixed. Whenever the Eskimos go out onto the ice to camp for overnight seal hunting, or if they should happen to be caught out beyond an open lead, they look for the largest pile and camp right next to it or on it.

Of course when an ice pile is chosen as a camping spot, the size of its base and the size of the flat ice surrounding it is considered. If there is only a little flat ice around the pile, and the edges of the small rough areas, such as surround every flat ice pan, are close to the ice pile, it is not so good for a camp as if there were more "room" around it. This is because the ice around each pan or flat area grinds away when there is ice movement, especially during the spring thaw. Stefansson (8) warns that a crack or grinding area several hundred yards from a camp can eat away at the ice very rapidly, especially if the flow on which one is camped is not as thick as the one against which it is grinding. He warns that the greatest danger is when the lines of motion of one's floe and of the adjacent floe intersect at a small angle such as $10^{\circ}$-$30^{\circ}$. One should never go too close to active ice piling or ignore it if it is close to a camp.

Polar ice -- ice that has become fresh and is over a year old -- is not a proper place to camp when on the sea ice, although it often seems that it would be because of its thickness and because it usually appears to be less crushed than the surrounding winter ice. In the first place, this ice is not nearly so thick as piled ice, being only 10 or 12 feet thick, which hardly equals the smallest ice pile. Secondly, polar ice is brittle and breaks more easily than the resilient salt ice of high piles and ridges. And third, polar ice melts more rapidly in the spring, making it less reliable over a period of time because it detericrates and honeycombs.

There is one major exception to the rule of camping on ice piles and ridges, but it still does not allow the use of polar ice. On large unconsolidated or semi-consolidated ice floes of spring and summer it is safe to stay on an ice pile only if the ice is not moving. When the ice is set into motion, however, it is better to seek out the heaviest and largest flat ice pan or field. The top-heavy ice piles may turn over or shift in the water when set into motion by wind and/or current.

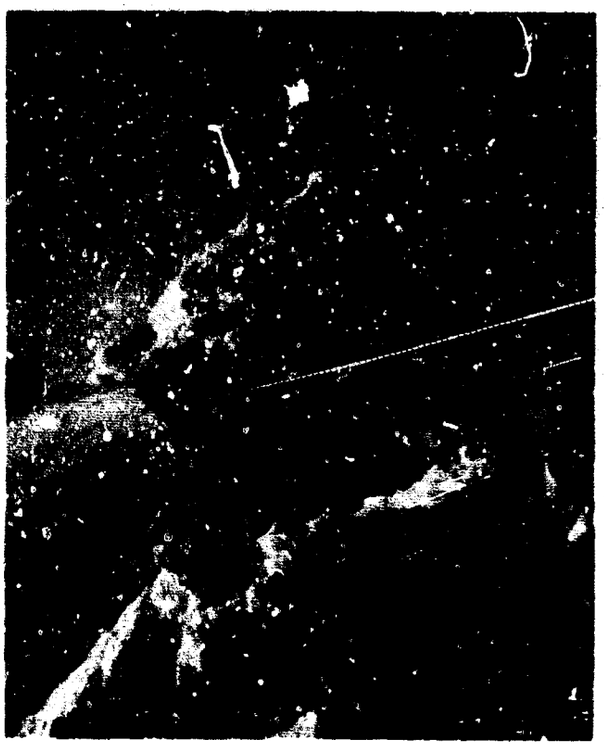
Ice ridges, piles, or large hummocks make convenient places for camps in the winter because a small shelter can be made in among the large crevices or caves, as long as the pile is soldily consolidated (i. e. is not freshly formed). The ice making up the formation should be fairly thick for the greatest safety, around one and a half to three feet thick. This heavy ice forms crannies large enough to shelter one or several men. According to the old custom a man did not lie down in his shelter, even if he had sufficient skins to pad a large enough area. Instead the shelter was made with a snow-block seat, so that the man sat upright. One man said that it is "bad luck" to lie down, but there are also factors of heat loss and preventing the survivor from sleeping so soundly that he will not be aware of changes in the ice condition.

## Procurement of Fresh Water

Another major problem of ice survival is the procurement of fresh water for drinking. For the Eskimo, or anyone with a basic knowledge of the technique used to obtain water, it is actually no problem at all. First, there are two facts of vital importance: (1) snow is not a source of drinking water if it is to be eaten, and (2) salt water ice cannot be used for drinking. These restrictions seem formidable ones on the sea ice, but there are actually several simple methods of obtaining water.

Most importantly, snow can be melted by several easy methods. It must be melted because in most cases eating snow induces greater thirst, parching the throat, and may even cause weakness. When snow is taken from winter ice, especially young ice, it must be scraped from the top layers, not from deep down near the salty moist ice surface. If there is an ice crust on the snow there is an ideal source of water because this ice is more easily melted, is fresh, and can even be eaten safely. The best snow for melting to make water is granular snow, such as is found beneath the surface of drifts, on the tundra especially. This grainy snow has a much higher water content than very fluify snow, while the hard-packed snow from the upper part of drifts is intermediate in value.

The old Eskimo method of melting water from snow made use of the skin of seal flippers. This skin could be used to make a little pouch or bag which would hold water and served as a melting apparatus. Snow was put into the bag in the morning, and the bag was placed inside of the clothing next to the skin, where body heat melted the snow. As water was drunk from it, more snow was placed inside to replace what was used. One man at Wainwright told of using a modern version of this when he was lost on the tundra. He made fresh water by putting snow in an old tin can and holding it against his skin.



A hunter standing atop heavily piled polar ice, scaning with binoculars in search of bears.

Icicles such as these, when formed by melting of snow on top of heavy ice, provide a source of fresh water. In winter, however, icicles are salty. Photograph near Point Hope.

Another old method utilized the stomach of a freshly-killed caribou. In this case the outside of the stomach was cleaned well and then it was turned inside out and filled with snow. The container was thrust into the body cavity of the caribou, where the heat still retained inside would melt the snow.

Seal blubber can be burned to procure fresh water from snow or ice. After the seal is skinned, its hide, with blubber attached, is placed in a depression in the snow, and snow blocks are put up around it. Wick material is placed in the fat and oil and then is lit. The fire melts the snow, and water collects in the solid ground or ice depression below. On fresh ice, such as polar ice, pieces of blubber with wick material such as cloth are burned right on the ice itself. Around the fire, radiating out from it, one or several channels are chipped in the ice, so that the water which forms will collect in several deeper depressions within these troughs. Water is taken from the hole farthest from the fire, at the end of the trough. The holes nearer the flame collect water that is tainted from the fire and has a bad taste.

In modern times the gasoline stove is carried out onto the ice, or hot tea is taken out in a thermos bottle. Fresh snow or ice is used to make water in pots over the stove, and sometimes good ice is carried from the village on the dog sled. The most noticeable characteristic of snow melted this way is the fact that large quantities of it are needed to make a little water. This of course requires considerable heat, and therefore uses a lot of gasoline. Eskimos usually keep the pot stuffed with snow until it soaks and melts enough to fill with slush, and then leave it until it boils. The stove is shut off immediately when the water begins to boil, unless it is inside of a tent where it is being used to heat the air as well.

Of course fresh ice is found in polar ice, and is easily identified by its dark blue or almost black coloration and its brittleness. However, there are other fresh ice sources on the sea ice. In the first place, salt ice begins to freshen shortly after the spring thaw starts, after perhaps a week or 10 days of above-freezing weather. The freshness is caused by downward percolation of the salt, so it is best to look at the tops of hummocks for fresh ice. The ice changes color as it freshens, losing the light green or turquoise hue in favor of a bluish or whitish cast. The Eskimos begin finding fresh ice at the tops of high ice piles at first, soon afterwards on the lower hummocks and pieces. They may also make fresh ice by standing a rectangular piece on end in the sun and allowing it to freshen for a few days. This or any fresh ice can be eaten for water.

In the spring there are also icicles, which are found beneath overhanging ledges and pieces of sea ice. These icicles may become fresh by losing the

salt which was in them when they formed in winter, or by being derived from the drippings of thawing snow and/or ice. In the winter, icicles form from sea water running off of chunks of ice after they are pushed up above the water surface during piling. These salty icicles are not clear, but are more or less opaque, like the winter ice itself. In spring, however, they are clear and fresh, and can be broken off easily to melt or to chew.

The other source of fresh water on sea ice is puddles, and perhaps even the slush, which form on the ice during the spring due to the melting snow. The first puddles develop wherever there are dark spots on the ice, such as in places where there is dog manure along the trail or where a dark object has fallen onto the snow. Later on the puddles are everywhere on the ice, and according to the Eskimos they are fresh enough to use for drinking water.

## X

## BIOLOGICAL ENVIRONMENT

Were it not for the fact that above and below the sea ice there is an exploitable resource of animal life, the Eskimos of this region would seldom travel onto this uncertain media. But the fact is, the waters beneath the ice-covered coastal slopes are in most places rich with life. The currents which flow deep beneath the surface carry with them millions of tiny organisms, giving rise to a long chain of biological interrelationships. The invertebrates and the fish live always beneath the surface of the sea, but form the prey of those larger animals which must rise to the surface to breathe air. Because the sea ice moves and cracks with the constant motion of the wind and tide, and because the food is so rich, there are seals in abundance all year around, joined by birds, whales, and walrus when the spring spreads its warmth northward. And on the surface of the ice, polar bears stalk quietly after the seals, leaving behind them food for white foxes, whose tiny footprints so often are seen following in the bear's trail. And competing with the polar bears for food, or hunting the bear itself, are the Eskimos.

The mammals that are found on and under the sea ice, or along the edges of openings in it, are infinitely more important to the Eskimo than the birds or fishes. The taking of a single whale supplies literally tons of meat, but is not as reliable a food source as the seals because of the uncertainty of getting whales in a given year.

As was done in the preliminary report, this report will classify the sea mammals into five major categories. Of these categories there are two

main divisions: the animals which walk on top of the ice and those which live in the water. Each species will be considered separately because, except for the species of large whales, they are distinct enough in their behavior to require special methods for hunting them. The categories, in order of appearance in the text, are as follows:

(1) Fox: Arctic fox (Alopex lagopus)
(2) Bear: Polar bear (Thalarctos maritimus).
(3) Whale: Beluga (Delphinapterus leucas) Large whales (Balaena)
(4) Walrus: (Odobenus rosmarus)
(5) Seal: Harbor seal (Phoca vitulina) Bearded seal (Erignathus barbatus) Ringed seal (Phoca hispida)

The Eskimo must know the ice to hunt upon it, and at times he must hunt successfully on the ice or face starvation. In order to hunt successfully he has gathered the data from several thousand years of observation on the behavior of the game he pursues and of experimentation on methods of exploiting these behavioral characteristics. The availability of the game determines where and when the Eskimo will be found, and the methods of exploiting the game, sometimes more than the actual presence of it, determines its availability. We must, therefore, consider what changes have taken place in the methods of exploitation in the recent past in order to understand the changes in settlement pattern during the same period. Eskimo economy has undergone a tremendous change since the introduction of certain methods of procuring game, such as hunting with firearms. These changes have greatly altered the way in which the Eskimo goes after food, the dependence upon particular conditions of ice or weather for hunting, and the overall productivity of the constant search for food.

Let us now consider, one by one, the resources of the sea ice environment; the methods of exploiting them, their productivity and efficiency, and their effect upon the movements and the total ecology of the Eskimo of northwest Alaska. Again, this is largely descriptive account, since the purpose here is to discuss the variety of methods of dealing with each particular aspect of the sea ice environment, and whatever conclusions or generalizations are made as to the significance of a particular factor or phenomenon to the total ecology, past or present, are done theoretically and not on the basis of quantification or intensive specific study.

# XI

# INVERTEBRATES AND FISH

## Invertebrates

The northwest Alaskan Eskimos have never made much use of invertebrates as food for themselves or for their dogs. In recent years there are only two types which are ever taken, shrimp and crabs, and neither of these makes more than a diminutive addition to the food resource.

In the late fall of 1964, just as the slushy new sea ice was beginning to be pushed up to the beach, there appeared along the shore at Wainwright large numbers of small shrimp. These shrimp, measuring perhaps one or two inches in length, could have been taken with small dip nets right from the shore, but considerable effort would have been required to gather enough of them to use for food. The Eskimos said that during the spring the shrimp are netted in whaling camps, when they are larger and occur in great abundance, and are used to make "soup". The local B.I.A. school teacher reported that in the preceding fall a tremendous storm washed ashore large windrows of shrimp, which he, and perhaps some of the Eskimos, gathered in buckets and bags in such quantities that they were used for dog food through most of the winter. During the winter of 1964-65 and the following spring no use of shrimp was seen at Wainwright or Point Hope.

At both of these villages, however, there is still crab fishing during the spring from late February or early March until almost the end of whaling season. Crabs are caught by sinking a small wire grid, through a hole or from the lead edge, which has been baited with a seal head, seal meat, or blubber. The grid is left on the bottom for "10 or 20 minutes" according to Van Stone (4) or perhaps up to more than an hour as reported by an Eskimo informant at Wainwright. The grid is then pulled up with the long line attached, often bringing with it over a dozen crabs which were feeding on the bait.

## Tomcod

Fishing for tomcod or ikalurak (Boreogadus saida) is done through the sea ice by Eskimos in many of the villages along Alaska's Arctic coasts. This activity has become less and less important, however, and is no longer done at Wainwright, where there is a richer resource of fish taken

from the Kuk River. It may still be carried on at Barrow, but there is definitely active cod fishing nowadays at Point Hope between January and March.

The tomcod is evidently a migratory species, so that it is only available at certain times of the year. At Barrow the cod do not begin to run until the beginning of February, but they remain until the ice is rotten in spring (6). The fishing is done close to the beach, which may be simply for convenience or because the fish run close to the shore in shallow water. At Wainwright several men stated that seals were feeding on cod near several large ice piles about two miles offshore, which indicates that the fish may be found quite far out.

The cod tend to congregate in the lee of large piles of ice, where there is little current, so that they change their position relative to the direction from which the current flows. Thus the fisherman will make his holes through the ice on different sides of an ice pile depending on the current. Murdoch (6) stated that the Barrow natives preferred to fish in flat places with hummocks surrounding them. The fishing hole is chopped through the ice with a heavy ice chisel made of a wooden pole with an iron point (formerly bone or ivory). The hole, about one foot in diameter, is kept clear with an ice scoop (ilaun), consisting of a wooden handle two to four feet long, with a webbed scoop fastened to one end. The scoop has a rim approximately eight inches in diameter made from caribou hoof or horn, and a mesh made from baleen. Some of these scoops are made nowadays with a metal rim and wide-meshed wire screen.

The cod fishing rig described by Murdoch (6) consists of a line 10 to 15 fathoms long, with a stick attached at one end and with an ivory or metal "sinker" at the other. This "sinker" has four hooks made of two pieces of iron passed through it at right angles and bent around to the correct shape. In modern times the Eskimos use manufactured triple hooks, but this old type may also be retained.

The line is let down to about a foot off the bottom and there it is jigged up and down to attract the fish. Farther out from shore, if cod can be caught, the line would perhaps not be so close to the bottom, but this is merely conjecture. Fish are lured close to the hooks and are snagged by them as they are jerked up and down. Once one of the little fish is hooked, it is reeled up by winding the line several times between the fishing rod and the handle of the ice scoop or another slender stick carried for the purpose. Around Bering Strait the Eskimos had basically the same method, but placed a windbreak around them which was made from "grass mats". In that region the daily fish yield is listed as 10 to 40 pounds, and up to 200 pounds, according to Nelson (2).

Other fish are taken at the same time, undoubtedly some type of sculpin (cottidae). Most of the fishing is done by women, children and old men, who go out daily in groups of five or six. The hunting men will fish only when there is nothing else to do. This is, therefore, one of the few resources which can be exploited by the non-hunting segments of the local population.

Although they do little actual hunting, these individuals can make contributions to the larder by less direct means. These include communal methods of hunting, seldom used nowadays, in which women, children, and old men are used in order to aid the hunter in capture of game. Most important of these to the aboriginal culture was the interception of caribou herds and funneling them, by means of lines of people and piles of sod or stones, into a corral, river, or lake. In this case they were killed with bows or lances, usually from kayaks. More familiar to the coastal Eskimos is the method, formerly used near Barrow, of frightening flocks of ducks into specific lines of flight which took them over the hiding place of hunters. And for seal hunting there is a technique used in the eastern Arctic, by which each man, woman, and child stations himself at a seal hole, the none-hunters merely frightening the seals away from their holes so that they will be forced eventually to rise in a hole watched by an armed hunter. In these and other ways the individuals who seldom actually kill game are able to give vital assistance in the hunting. Women were also able to help, in former times, by bringing seals or caribou home after the men had killed them.

## Smelt

At Wainwright it is mainly this non-hunting segment of the population which does the fishing for smelt or ilhoġaniķ (Osmerus dentex). The smelt begin to run up into the Kuk lagoon behind Wainwright sometime in January and remain through March, but the availability of these small fish varies markedly according to the current. There is also apparently a considerable fluctuation from year to year in the abundance of smelt.

The method of fishing is essentially similar to that used for tomcod. A hole is first chopped through the ice, preferably in a crack where the ice is thin or there may even be open water. The hole is made with a tuaķpok, a wooden pole with an iron point. The pole usually has been made so that it has a bulbous enlargement near the lower end, which makes it heavier and therefore a better ice chopper. Once the hole is made, through ice up to five feet thick, the man, woman, or child sits on his sled or stands and jigs for fish. Because it is done in the coldest part of the year, the warmest clothing is worn, layer upon layer of it, and a snow-block windbreak is often used.

The pole is about two feet long, and has attached to it a line made nowadays from monofilament bought at the store. At the end of the line, which is six or seven feet long, is a sinker made from a walrus tooth, sometimes with a piece of lead set into it to increase its weight. A hole is drilled through the lower end of this sinker, and a thin strand of baleen is placed through it. This baleen acts as a springy crosspiece, and suspended from each end of it, by a six-inch long piece of gull wing tendon, is a hook. Another hook usually hangs straight down from the bottom of the sinker, also tied with gull wing tendon. The hooks are slender, curved pieces of ivory, dog tooth, metal, or plastic, with a hole at one end for the line and a sharp metal barb set out from the other end. Often there is a piece of red wool or plastic set onto the base of this barb. These hooks are jigged up and down until a fish is felt on one of them, and then they are pulled up by winding the line once over the left sleeve and once over the end of the pole.

There are many subtle influences of the current which must be taken into account when fishing, because the fish move in schools from the direction of the current. Most importantly, the rising of the tide before and during a south wind brings the smelt into the lagoon in tremendous numbers. Very large catches, up to 300 and 400 fish are taken on the best days, while on poor days none may be caught. Usually sculpins are caught at the same time, or during October through December these less favored fish, called kanaiuk, may be specifically fished for. During 1964-65 the fishing was unusually poor, but there were groups of people out fishing almost every day when the weather was good during February and March. Smelt are never fished on the open sea ice.

There is also an important fishery up the rivers inland from Wainwright and Point Hope, which is still carried on to some extent today. For our purposes this is not important, however, so we will move on to consider the more productive resources of the sea ice.

## XII

## BIRDS

### Introduction

Birds of any type are available in this region only during the spring, summer, and fall, and of course only certain species are found out over the sea ice. For the most part there are the marine waterfowl such as eider ducks, the various species of gulls, and some Alcids. The Eskimos

have named each species of bird, and are experts at identifying them from a distance, not only by their appearance but also by their behavior. Even the young boys at Wainwright were able to name many species of birds and distinguish between closely similar species. For the purposes of this report there will be more attention given to the methods of taking birds then their migration patterns and time of occurrence.

## Sea Gulls

At Wainwright, glaucous gulls or nauyak (Larus hyperboreus) are hunted during late September through October as they migrate southward, following along the beach. Men station themselves below the cliffs that back up the beach and shoot the low-flying gulls with shotguns. Gulls can be attracted as they pass by if the hunter throws his first-killed on the beach. The others will slow down to investigate it and make easier targets as they hover or circle. They will also stop to look at a dead gull floating in the water. Gulls can also be attracted by mimicking their call, which sometimes brings them in close enough for a shot.

A well-known method of catching gulls without shooting them is the use of a sharpened stick tied into a line, and concealed inside a wad of bait. The gull swallows the bait and tries to fly off, but as it does the stick turns crosswise in its neck and it is then captured by pulling in the line. Boas (16) documented another clever method of capturing these scavenging birds, which he observed among the natives of Cumberland Sound: "A favorite method of catching gulls is by building a flat snow house. One block of the roof is translucent and so thin as to permit the hunter, who is hidden in the house, to push his hand through it. A bait is placed on this block, and as soon as a bird alights to feed it is pulled through the roof into the hut."[2]

During the spring the gulls again ride the winds north, and are seen in abundance around the leads or flying over the sea ice during whaling. At this time there are not only glaucous gulls but also some ivory gulls or nauyavaak (Pagophila eburnea). But in spite of their abundance at Point Hope in May 1965 they were ignored, and were not even shot for dog food, despite the fact that some men were running short of it. Gulls are not hunted enough, spring or fall, to make a valuable contribution to the larder, but they could perhaps save the life of a sea ice survivor since they arrive early in the north, leave late, and are not difficult to procure.

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[2] Reprinted from The Central Eskimo by Franz Boas, by permission of University of Nebraska Press. Copyrighted 1964.

## Alcids

Along the coast, at least in the region between Wainwright and Barrow, and perhaps farther south, there is one species of bird which is seen in the open leads during mid-winter. This is the black guillemot or inagik (Cepphus grylle). Guillemots arrive in the late fall, after the sea ice forms, and somehow must manage to find open water all winter long. By no means are they seen every time the lead opens up, although some may be spotted during any part of the winter. At Wainwright the writer observed them in late November, at various times during January, and in early February. The modern Eskimos at Wainwright do not hunt them today, unlike the Greenlanders who hunt the more abundant flocks which occur there, but do know how to get them if they want or need to.

The guillemot is not much afraid of man, and in fact seems to be attracted to him, making an easy target for any kind of rifle. Guillemots are best hunted with a .22 caliber rifle because they are small and occur singly or in pairs for the most part, so there is little need for a shotgun to kill them. Their white color makes them very conspicuous as well, and if the hunter waits patiently along the ice apron he will probably be able to shoot them from only 20 or 30 yards or less. There is of course the problem of retrieving the birds once they are shot, if they are along an area of thin ice so that they cannot be picked out by hand. In many cases the wind and/or current also carries the bird away from the ice, so that the small skin boat or else the retrieving hook has to be used.

In former times the guillemot was caught in nets, which were placed along the lead edge below the surface of the water. They are, as mentioned above, attracted to men moving around along the lead, and they can also be brought close by throwing a piece of ice into the water. Once they had gotten over the net the hunter would frighten them suddenly, so that they would dive down into the net below and become entangled in it. Actual methods of setting the net, its dimension and weave, etc. were not described by the informant.

The only other Alcid which occurs in this region around the sea ice during the regular ice hunting season is the akpa or murre (Uria lomvia) and U. aalge). At Point Hope the murres arrive early in May, and from that time clear through the summer they are seen continuously, flying back and forth between the large nesting colonies at Cape Thompson and Cape Lisburne. They arrive somewhat later at Wainwright, where they are seen in open spots for a few weeks before they return south to their nesting places. At Point Hope the murres continually fly north or south over the spit, depending upon the wind. They have a habit of flying against

the wind, so that their movements can be forecasted on a given day according to the wind direction.

On some days the murres in this region are seen almost constantly as they fly in long strung-out flocks. Unlike the eider ducks they do not fly low, but are from 50 to several hundred yards up. This, and their habit of flying side by side, in lines which may be over a quarter of a mile long, makes them difficult to hunt when they are on the wing. The only possible way to shoot them would be with a light rifle, and then it would take quite a marksman to get any.

Out along the lead, or in open spots, the murres are easily hunted. There are "always" at least a few murres in sight during whaling, as they swim along the surface and periodically dive in search of food. By stalking or simply waiting for them to swim close, hunters can shoot them with rifles or shotguns. In whaling camps the men amuse themselves by waiting for a group of murres to swim close, and then pick them off one by one with .22 caliber rifles. The Wainwright people are said to be more business-like, using shotguns to kill large numbers of them in openings. After each shot some lie dead on the water, while the others dive below the surface. But these soon rise again and do not fly. In this way all of the murres in an open spot may be shot. In the open lead, where there is more room, they will swim away after a shot or two. Also near open water they can be taken with shotguns as they fly low or come in to land. They are usually heard before they are seen because their wings whistle loudly.

## Ducks and Geese

Certainly the ducks are far more important as a food source than the rest of the birds put together. They are not only the most easily available, but also the most highly preferred type of food. During the spring and fall there is a considerable effort put forth to procure ducks, which are stored by freezing them in underground cellars and used during the periods when ducks are not easily available. The eider ducks and old-squaw are the important ones taken on the sea and the sea ice. During their migrations north in the spring and south in the fall they are seen in staggering abundance, flying low over the ice or water, one flock following close on the heels of another. At Wainwright during the fall the eiders flew in long strung-out flocks low over the water, some of which took 15 or more minutes to pass.

There are three species of eider duck normally found here: king eider (Somateria spectabilis), called kinalik in Eskimo; common eider (Somateria mollissima), called amaulik or mitik; and spectacled eider (Somateria

fischeri) which is called kavasuk. During the spring the king eider is by far the most common duck, and apparently it is the easiest to hunt. These ducks, including the ahalik or old-squaw (Clangula hyemalis), are not hunted from the ice in the fall because they leave before it forms. They are shot by men going out after them in skin umiaks, as the ducks fly or, preferably, while they sit on the water in tremendous flocks. The men pursue them with the outboard motor-powered boats, shooting into the thickest concentrations with shotguns. At times these flocks are so huge that the air almost roars with the sound of their wingbeats as they rise in alarm. During the spring, when there is a lull in the whaling, men will go out in the lead and sit in their boats, waiting for eider ducks or old-squaw to fly over, and shoot them with shotguns. Sometimes they also pursue ducks that are in the water. The black brant (Branta nigricans) is taken in large numbers around Kasegaluk Lagoon near Icy Cape during the fall, also from boats or from the beach. One man at Wainwright said that he had shot 29 brants with two shots of his 12-gauge and carried boatloads of them back to the village during the fall.

Spring, however, is the real waterfowl season, especially for eider ducks. In modern times the men shoot them with shotguns either from the beach or out on the sea ice as the ducks fly over. At Point Hope the ducks follow the shore along the south side of the spit, so men wait on the beach or in the ice just offshore, concealing themselves behind snow-block walls, small blinds made of sticks, or rough ice. During spring whaling it is mostly the old men who hunt ducks at Point Hope, but at Wainwright more of the able-bodied men do so because there is less whaling.

The ducks do not fly in large numbers every day, but prefer to fly when there is a south wind favoring them. The flocks number 10 to 75 ducks in each, and on a good day will follow 5 to 15 minutes apart. The ducks fly very low, about 5 to 20 yards up, when it is not too windy, and stay in very tight formation. A hunter can get more than one duck, and up to 10, with a single shot of his 12- or 16-gauge shotgun. Usually the men wait to fire until the ducks are passing to the side or overhead, or a little beyond their position, because this way there is the greatest possibility of breaking wings. Head-on shots are said to be the least effective for getting several with one or two shots. Each hunter is spaced 50 to 200 yards away from the other, and during a day's wait he is fortunate to have more than several flocks fly close enough for a good shot. At Point Hope the hunters are aligned with the ducks' direction of flight, along the beach, but at Wainwright they can spread out across the line of flight over the sea ice.

It is necessary to watch very closely in the direction from which the ducks will come, because they are difficult to see until they are close. Eiders always utter low punctual quacks or groans as they fly, which the

Eskimos imitate by saying "kau, kau, kau...", and this is sometimes heard before the ducks are seen. When the birds are approaching, the Eskimo, wearing his white parka cover, hides or sits quietly. If he wounds one and it drops on the ice he runs and grabs it behind the head, spinning it around just off the ground to wring its neck. He then resumes his wait. A man and his son at Wainwright boasted of taking over 500 ducks in two days by this technique. Old-squaw ducks are not taken this way because they are high-altitude fliers. All of the ducks shot in spring-time hunting are used by the people, and there is no waste because killed ducks are always retrieved.

Before the introduction of firearms, ducks were taken by the use of bolas (killemittaun) as they flew low over the sea ice or points that protruded out into their line of flight. The bolas consisted of six or seven small weights made from walrus teeth or ivory, each on a string about 30 inches long. The strings were tied to a tuft made from nine wing quills, which were doubled and had the strings securely held in the folds and bound around the outside. The bolas were carried by putting them together in a series of slip knots, which prevented them from tangling, and then placing them into a pouch hung around the neck.

When ducks came into sight, the tuft of quills was grasped in the right hand, the balls in the left, and a quick pull straightened the strings. The balls were whirled overhead once or twice and then flipped into the air ahead of the oncoming ducks. As the balls flew, the weights spread apart, covering a circular area four or five feet in diameter, and if any part of the bolas struck a bird the rest of the balls would wrap around it and send it plummeting to the surface. These bolas were said to have an effective range of 30 to 40 yards. Several were carried by each man, woman and child most of the time during the migrations (2, 6).

Ducks were also netted during their low flight over the sea ice, an activity which was often conducted cooperatively. Nets made of sinew were laid out on the ice in areas where ducks would be especially likely to be flying low, such as over corners in the lead edge or places where they fly over (or around?) ice ridges and do not see the net until it is too late to rise above it. The net was stretched between two poles or between ice chunks, but would be laid on the ice until the ducks were at just the correct distance from it. Then one or two men pulled the net up by ropes strung over the tops of the poles or ice. One man could tie his net to an ice pile and then pull the other side up. The ducks which fall onto the ice must be caught quickly, before they fly away.

One of the most ingenious contrivances was the capture of ducks without any tools at all except the voice. On days with very heavy fog the ducks

become soaked with moisture and fly low. Men waited in concealment until the ducks were almost to them and then would jump up and shout. The ducks would try to turn suddenly, and in doing so would fall to the ice because of their extra weight of moisture and once on the ice they were caught and killed.

The last of the pre-rifle methods of capturing ducks is snaring. A pole is laid in the water or held above the ice at the edge of an open spot in the sea ice, and spaced along it are a series of slip-knot snares made of baleen. Ducks come in along the ice or up onto it to rest in small bays or ponds, and as they swim along, their feet or necks become entangled in the snares. The pole is in some way tethered to the ice, or in fresh-water spots it is anchored to the bottom, but is evidently arranged so that the snares will stay parallel to the water surface. It may also be used on the ice itself, to catch ducks by the neck, but informants were unclear in their descriptions. A snare described by Nelson (2) for the Bering Strait area is evidently of a type which is set above the water and snares the ducks by the neck.

## XIII

## ARCTIC FOX
## (Alopex lagopus)

### Feeding Habits

The small white fox (pisukkaak) is believed to owe much of its ability to live on the sea ice to the polar bear, which it depends upon for part of its food. It is improbable, however, that the fox lives entirely on the remains of seals left behind by the bear, which usually eats only the skin and blubber and leaves the rest. Foxes are gifted with a remarkable ability to smell out food far below the snow surface, either that which they cached on land during the summer or something that died or was killed and became buried. Because of this ability they are undoubtedly able to find dead walrus and whales which become encased in the pack ice and which they can either dig down to or wait for a polar bear to dig out so they can eat after the bear leaves.

Eskimos have learned to watch for places where foxes urinate on the snow because they tend to do so when they smell meat below. Several men told of finding caribou carcasses, which they had left in the fall and which had become buried deeply in hard snow, by looking over the area for the places where foxes had urinated. Kusik told of catching a fox in a trap after the animal had dug down through several feet of snow to get at it. Men

who might become lost on drifting ice could perhaps follow the fox and bear trails to find food in the form of dead seals, walrus or whales. In the winter of 1964-65 there were some whales harpooned and lost at Barrow, and the Eskimos felt that there must be several dead whales encased in the pack ice which were attracting the bears and foxes far away from the shore.

Because Arctic foxes must live as scavengers on land and on the sea ice, they are able to withstand lack of food over long periods. One Eskimo reported that he had seen two instances where live foxes were caught in a trap when he first saw them, and he passed back a week later and saw the same foxes still alive. In both cases he knew that it was the same foxes and that the traps had not been checked and emptied, so he killed the foxes and left them for the owner of the traps.

## Rabid Foxes

There is one danger from foxes, and it is not an uncommon one. During this study, at both Wainwright and Point Hope, rabid foxes were killed which had entered the village and in two cases had even entered the hallways of houses. It is not uncommon for rabid foxes on the sea ice to walk right up to a human. In some cases these have to be beaten off with a stick or rifle. The Eskimos call such rabid animals mulukalairaq, and although they fear them they still skin foxes which are killed when obviously rabid.

## Pitfalls and Snares

Besides shooting foxes, which is done whenever one is seen within range, there are many ways of trapping them. The old-time methods have all been given up in favor of modern steel traps, which are evidently more efficient. One of these old methods is the pitfall or qazagisaaq, of which two types are described:

The first type of pitfall consists of a hole dug into the snow which is too deep for the fox to jump out of, and which has its sides made into ice so that the fox cannot dig out. Sharp pieces of antler are placed vertically in the bottom to impale the fox when it falls in. The top of the hole is covered either with a thin slab of snow, willow sticks protruding from the edges with snow covering them, or flexible pieces of baleen covered with snow. The baleen is ideal because thin slats can be stuck out from the sides and will bend downward to release the fox into the pit, springing back to position afterward. Usually a sort of "drift fence" is set up with snow-blocks to guide the foxes to the trap, and the bait is placed on the far side of the trap so that the fox will walk over the opening.

The second type is a "box" of ice blocks with an open top. Baleen slats are stuck out from the edges to conceal the open top, and are covered with snow. A ramp of snow leads up to the top and the bait is placed on the far side. The fox falls into the box when he tries to walk across the flexible baleen, which snaps back into position to catch another fox if one should come. The box has to be made deep enough that the fox cannot spring to the top and escape.

Another type of trap is also made with an ice block "box", this time with a roof of ice. Two round holes are made in each side and one in each end, each large enough to admit a fox. Bait is placed inside and the box is left this way for a while so that the foxes get used to entering it to get food. When the Eskimo sees that there are many tracks around it he sets the trap by putting nooses around the inside of each opening. Each noose is hung so that it encircles the hole, and the end of the noose goes up through another hole in the top. A trigger mechanism is made whereby the fox, putting its head inside, releases a weight attached to the end of the noose. The weight falls, and with the line going over a "pulley" of ice, snaps the loop part of the noose tight enough to strangle the fox.

## Steel Traps

In addition to these, several methods of making deadfalls and snares were described, some of which were used on the land only, and the others were described in the preliminary report of this study. More important here is the modern method of fox trapping. The northwest Alaskan Eskimos have become expert at fox trapping since the fur trade became available to them. Before this there was probably no great effort made for trapping these animals, which offer little meat and only a fragile hide. After the beginning of fur trade and the introduction of steel traps, the Eskimos put in a great effort for trapping, some of them leaving the village for weeks at a time to run traplines that stretched over 100 miles and took a week to travel end to end. Nowadays the fox pelt has decreased in value and the longest traplines run 50 miles, the men rarely leaving the village for more than a week at a time, during which they also do some hunting. The best trappers alive today are 60 years old or more and are no longer active.

There never was much fox trapping done on the sea ice even though there are plenty of foxes there, because the ice "steals" too many traps. During the field study one man, one of the old expert trappers, set a few steel traps on the ice and lost them when the ice broke away. At Point Barrow the writer saw fox tracks in incredible abundance just a mile off-shore. For several miles he was never out of sight of at least one set of tracks, and often the ice piles were dotted with tracks as if there were so

many lemmings. However, few trappers are willing to walk through the rough ice to check their traps, or to risk losing them when an offshore gale breaks the ice away.

Traps are often set near the carcasses of caribou which were killed in the fall or winter, and are being visited regularly by foxes. Otherwise they may be set next to old walrus or whale carcasses along the coast, or by any small mound of earth or prominent mark such as an old caribou antler, where the foxes stop to urinate. If a trap is set on a mound of earth, the snow is scraped away to make a conspicuous black spot which will attract foxes.

When set near dead animals the traps are put on the west side, because the foxes usually approach from downwind and will step on the trap before reaching the meat. The fact that winds blow prevailingly from the east makes it easy to predict from which direction the foxes will come, because they will smell the meat from downwind. Little or no caution is necessary when walking on the snow while setting traps, except that the Eskimo does not step downwind of the trap set. When bait is used, as on top of a mound, it is usually frozen stomach contents of caribou, with some meat perhaps used also. The frozen guts are easily carried and can be chopped off with the large knife (savirakṭuun) which is carried. The bait is scattered just upwind of the trap so that the fox, reaching for it, will step on the pan of the trap.

The trap itself is put into a little excavation or depression cut into the snow, approximately the same outline as the trap. The trap is opened and set into this hole, and then a piece of snow a bit larger than the excavation and two or three inches thick is carefully placed on top. Snow is pushed in around the edges of the block where it rests on the surface to plug all holes, and then with the large knife the block is shaved thinner and thinner, until it is very delicate and about level with the surrounding snow. The trapper must be very careful not to break through this thin cover, especially as he then smooths the area with the knife or with a furry mitten. If the top of the snow packed over and around the set is not level, it will either be covered by a little drift, if it slopes to leeward, or will be eaten away by the wind if it slopes to windward. Beneath the set the trapper has buried the chain in the snow with a stick several inches long through the loop on the end. If he packs the snow tightly, it will harden solidly enough for the chain to hold the fox. The chain may also be frozen into freshly-killed caribou and the trapper returns later to set the traps.

Usually several traps are set in a particular place, so that the trapper can check more than one trap per stop. Each trapper has his own camp from which he travels out by dog team in various directions setting traps,

making each trapline long enough to occupy one day checking and returning to camp. Traps are also set along the route between camp and the village, or some men use the village as their base camp and have traps set close enough so that they can go out to check them and return home the same day. The trapping season lasts through the midwinter period and is strictly adhered to, some men starting out very early in the morning on the first day and pulling out their traps on the very last day. The beginning of the season on December 1 marks the beginning of winter for them, and the end of it on April 15 means the beginning of spring and preparation for whaling. After whaling is over the men hope for warm weather to bring the seals up on top of the ice and for open leads to hurry the arrival of the whales.

## Use of Foxes

Foxes are nowadays taken exclusively for their fur. Little use of the fox pelt is made by the natives themselves, except occasionally the tail is used as a cold-protector around the neck and chin. Pelts to be sold to fur dealers are prepared by "casing out" the skin, i.e., turning it inside out to remove it entire. To do this there are first four incisions made along the insides of the legs, so that the skin can be pulled off of them. Using a small hunting knife or a penknife, the trapper then cuts away the skin around the lips. The skin is then peeled back over the head, turning it inside out, the small knife used carefully to cut it free as it is removed. Once the pelt is off there are no holes in it except the natural orifices and the leg cuts. The pelt is then placed, inside out, on a wooden stretching frame, and is dried in the house for several days. When this is finished the pelt is cleaned, using flour, and is combed. It is then taken to the native store for sale.

Fox carcasses are apparently discarded, although they are often seen in neat frozen piles beside houses in the village. They are occasionally eaten, but only when they are fat. Preparation is by boiling for one to several hours. They are evidently not eaten raw. Foxes have often been the salvation of stranded or shipwrecked men in the Arctic, and the taste is said to be quite palatable.

XIV

# POLAR BEAR
(Thalarctos maritimus)

## Feeding Habits

> The polar bear derives all of its food from the sea, and usually is not found far from the drifting sea ice. The polar bear is therefore considered here as primarily a marine mammal, since it requires nothing from the land and may be found a hundred miles from it. These giant animals, which are frequently 10 feet in length and weigh 700 to 1,000 pounds, live all over the Arctic seas below 75° North (except in North Greenland, where they reach 79° or 80° North) (11).

They prefer the areas of greatest ice movement, and therefore are more or less absent from areas such as the quiet parts of the Canadian Archipelago, and are most abundant in areas like northwest Alaska.

Polar bears live largely on seals, which they kill by ingenious methods, but they also eat frozen carcasses of whales or walrus, which they find in the pack ice or washed up along the coast. Because they sometimes depend upon this type of food they have developed an acute sense of smell, and are said by the Eskimos to be able to detect a dead whale from "50 miles" away. On occasion bears have come across leads so wide that the opposite side was not visible, because they smelled a whale which the Eskimos were butchering. The jaws and claws of polar bears are obviously very powerful, since the animals definitely are known to feed on frozen walrus, which is often so tough that it cannot be butchered with an axe.

Polar bears often catch seals by waiting for them at their breathing holes, small openings through the ice where the seals come periodically to get air. Seals are extremely cautious when they come to these holes, so the bear has had to evolve some special behavior patterns in order to succeed in hunting them in this way. Were it not possible for bears to do this successfully they would have a very difficult time surviving whenever the ice closed up and there was no open water.

The first thing that a seal does when it comes to breathe is take a quick sniff of the air to detect danger. The bear must therefore station itself somewhere other than upwind of the hole. It is said that they sit or lie on the ice at a right angle to the wind while they wait, and indeed they may wait this way all day before a seal comes. It was also stated by an Eskimo that they will lie facing the east in a southerly wind and toward the west in a northerly wind.

If the breathing hole is in thin young ice the bear simply waits until the seal comes and then the bear crushes the surrounding ice with its front paws, simultaneously smashing the seal on the head. If the ice is thicker bears will excavate the ice all around the hole, weakening it sufficiently so that they can carry out the same method of killing, but they are always careful to fill the excavated area with snow so that the seal cannot detect the change when it arrives. Also in thick ice the bear may dig a hole through the ice some distance from the breathing hole and wait until the sound of the seal's breathing is heard. Then it will slip silently through the hole and catch the seal from beneath. The Eskimo who described these three methods had heard of them and had seen places in the ice where the bears had carried them out.

Whenever there is open water the polar bears can capture seals as they come up to breathe. The bears will make a hole through the ice as previously described, somewhere near the edge of the water. The hole may be through ice up to two feet thick, and the bears will conceal it either by leaving a thin layer of ice in the bottom or by covering it with their forelegs. When a seal surfaces in the open water the predatory bear slips silently into the water through the hole and attempts to catch the seal by swimming up to it from beneath. Sometimes there is no need for such elaborate preparation, and the bear just waits somewhere along the edge for a seal to come up close enough to slip into the water after it. The bear attracts seals to open water, just as the Eskimo does, by scratching on the ice. An old man at Wainwright had watched bears attempting to catch seals by swimming beneath the water after them, but he said he never observed an actual kill. When they fail to catch their prey, the bears usually clamber back to the ice again and resume the hunt.

Polar bears also hunt sleeping seals during the spring when they come up on the ice to bask and sleep in the sun. Just as the Eskimo hunter must do, the bears sneak slowly and carefully over the ice toward the seal, moving only when it sleeps, avoiding detection because of the whiteness of their fur and by covering their black nose with a paw. When they get within a short distance a brief sprint puts them on the seal, which is slammed dead with a paw. When they catch seals, as mentioned above, they usually eat the skin and blubber only. The Eskimos believe that bears are able to "case" out a skin, removing it entire by turning it inside out.

## Movements

In the section on sea ice it was noted that the Eskimos go out after nanuk, the polar bear, when there is a west wind and/or an offshore current holding the ice solidly against the coast. Bears are especially likely to be seen

just after a lead closes because they are often near the edge of an open lead, and cross over onto the landfast ice as the two sides come close together. When there has been a west wind, or for some reason the ice has not moved enough to open cracks, the people begin to watch for bears coming up close to the village, especially at night, attracted by the smell of meat which is cached outside. Not a few bears have been killed when they came right in among the houses at Wainwright, arousing the dogs to a great commotion, which warns the Eskimos of their presence. During the fall the bears come ashore so regularly around Atanik, 20 miles north of Wainwright, that men go up there and leave walrus meat outside the old sod houses to attract them, and then stay for several days or a week hoping to get one.

Polar bears are likely to be found at any time of the winter around Wainwright, but there are three principle movements or migrations known to move north or south through this region. In December the bears move north, often following the edge of the landfast ice. At this time in 1964 several bears were seen from the village itself, in one case almost up to the beach during broad daylight, and many trails were found passing toward the north. In February the bears apparently move south in a rather small migration. And in March they are again going northward in what is normally the largest movement and the best time for bear hunting by the Eskimos. It is said that during the migrations bears tend to follow each other's trails, so hunters will sometimes wait near a trail if they find one. The bears actually do most of their moving at night, sleeping during the day, which makes them more difficult to encounter.

## Tracking

Because bear tracks are usually the only indication by which the Eskimo hunter becomes aware that a bear has been in the vicinity, it is necessary for him to learn to recognize the information in them. An account of a polar bear hunt will illustrate these methods: We walked out from Wainwright before there was much light on December 10, hoping to find a bear before the morning twilight became very bright. When we reached the edge of the landfast ice we stepped right into a bear trail, which excited David and caused him to scan eagerly in the direction that the tracks led. Seeing nothing he knelt over the trail and, pulling off his glove, felt the snow between the sole pad and the depressions of the toes, where there was a little bit of raised snow. The snow was somewhat hardened, he explained, which meant that the bear had passed several hours before. If it was very soft the bear would be not far ahead, and had there been frost crystals (kanik) and considerable hardness there would be little point in following the trail because it would be at least a day old. We decided to follow it.

Our pace was very brisk, but the hope of finding the bear seemed to make it easy. We occasionally glanced behind us in case another bear should be following in the tracks of the first. A small pile of excrement was an important sign; frozen fairly solidly, it indicated again several hours since the animal had passed. David became less certain about following the tracks, especially since we were now quite far out and on relatively young ice. He pointed out that the bear, being a fast walker, was probably too far offshore to be pursued on foot. We climbed a pile of ice about 25 feet high a mile farther on and spent a long time scanning in all directions with binoculars. To the south, he said, there would be more tracks, perhaps fresher ones than what we were following.

We headed south, our movement paralleling the coast, because we had already gone out for several miles. David led along the smooth ice, of which there were great expanses this early in the season, but never did he go more than a few yards away from rough ice ridges and hummocks which paralleled our direction of travel. There were three reasons for doing this: (1) Polar bears follow the edges of rough ice and never move out onto large flat areas; (2) When the hunter is close enough to rough ice he can hide quickly and avoid frightening the bear; (3) If the young ice begins to move, the flat areas are most dangerous because they break and pile suddenly.

Perhaps a mile farther on we began to find cracks with one day's ice cover on them. David said that this would be a good area for bears because one might have killed a seal and remained nearby to sleep off its meal. We cross three more bear trails, one of which he said was that of the same bear as the one we had followed on the way out, and the other two made by a single other bear. Both animals were apparently following a rather zigzag trail, perhaps having smelled the village and investigated, then moved out again.

From the tracks the Eskimo was able to estimate that the bears were eight or nine feet long, a bit below average size. In both cases the depression of the pad of the foot, excluding the toes, was the length of an outstretched hand from middle finger to thumb, or about nine and a half inches long, and seven inches wide. When the bear was running, it left a long drag mark with its heels. When it was walking at a leisurely pace the distance between hind foot prints was equal to a long stride of a man, a little less than a yard in length.

While he walks, the Eskimo hunter continually scans and watches for the game he pursues. In this case, early in the winter, the bear's coat would be a dull white or yellowish color, but later on it is a brighter white, even to the point of appearing to shine. The bear will not always be seen as

as it walks, but may instead be resting, which they often do in a large depression dug into a snowdrift in the rough ice, raising their head to look around occasionally. They also may be seen lying astride high pinnacles of ice.

As the brief day began to fade, the northeast wind picked up slightly and began to cause the ice to move and shift. We hurried back to the land-fast ice, fearing that the ice would break away and strand us. On the way in, we followed a bear trail to within a quarter mile of the village, where the curious animal had finally stopped and risen onto its hind legs before sensing danger and running back out toward the ocean. David noted from the tracks exactly what the bear had been doing, and, with intense concentration, observed the behavior of the animal. Each place where it had licked the snow or sniffed it, where it had stopped to look around, where it had urinated, or had quickened its pace deserved a closer look and a comment. In this way the Eskimo learns to understand his prey.

When he returns to the village from any type of hunting or travelling the Eskimo tells the others what he has seen. If he has observed some peculiarity of the behavior of an animal, the others will hear of it and in this way enrich their own knowledge. And, of more immediate importance, the report of each hunter as to the presence of game or game signs will affect the hunting activities of the others. During each day or evening the men gather at the native store or the small "coffee shop" and exchange this type of information. These gathering places are therefore quite important for both social and economic functions. If one man has seen a bear, it is likely that many will go out to search for bears the following day.

In a similar way the presence of regular mail flights between the large and small villages has affected the efficiency of hunting, because the pilot always reports whatever game he spots on the way. On November 10, 1964, the writer's field notes from Wainwright recorded the following: "The pilot reported seeing two polar bears near Franklin Point on the beach, and fresh tracks on this side of Peard Bay. He also reported a large herd of caribou moving north between Wainwright and Icy Cape, with the closest ones near Killimantavik (12 miles south)." A day or two later one man headed north to look for bears, and several others went south after caribou. Success of polar bear hunting has been drastically reduced in recent years because of the rise of airplane hunting by wealthy outsiders, which, if nothing else, keeps the bears far out on the pack ice. And the Eskimos no longer go out every day looking for bears, especially not on foot as they used to, which also decreases their success.

## Stalking and Attracting

It is said that the best way to hunt bears is on foot, because this way the dogs do not frighten them and the hunter can stalk ahead of the bear and wait for a close shot. The best bear hunters also know how to attract their game, so that they do not have to walk so far to get it. There are two methods of attracting bears, one of which consists of using seal blood or blubber. When the men shoot seals and drag them up on the ice there is a trail of blood, and perhaps a puddle of it, on the ice. This is one means of bringing in bears which is not done purposely. The hunters always watch closely in areas where they know this has been done. Occasionally the seal hunters will purposely drag a seal in on the ice, behind their dog sled, so that it leaves a trail which a bear might follow even closer to the village. They may also leave pieces of blubber out along the lead edge before going home. This is especially effective if there is an offshore breeze to carry the scent outward over the ice. One old man said that some bears, especially very hungry ones, are also attracted by the noise of shooting by the seal hunters.

Another method of attracting bears, which is actually a method of hunting in itself, takes advantage of the stalking behavior of the bear. Ikaḳ explained that he once was walking across a large area of flat young ice and spotted a polar bear some distance away. He did not have a white parka cover on, so there was no possibility of stalking the bear without being seen. He decided that his only chance of getting it was to lie on the ice and "play seal", hoping that the bear would be fooled and try to stalk him. The bear shortly began to move toward him, so he alternately lifted his head and dropped it again like a seal does. The bear was fooled. Each time that Ikaḳ looked around, the bear stopped crawling toward him, covering its nose with its tongue, according to the story. Finally it came close enough and was killed with one shot.

Another old man said that his father taught him to use the same method to get a bear which is across a lead and cannot be shot because it would be impossible to retrieve it. If a bear is spotted before it sees the hunter, he lies down and "plays seal", being sure to remove his white parka cover because no seal is white. When the bear sees this it may slip into the water on the opposite side, hoping to catch a meal. When it does this the hunter jumps up, hides in some rough ice, and waits for the bear to come up onto the ice on his side of the lead. Not finding anything, the bear searches around, and when it walks close the hunter shoots it.

Normally an Eskimo will be near rough ice and in a position to stalk the bear, as long as the animal does not see him first, in which case it usually runs away. A white parka cover is always worn or carried in case a bear

is spotted, so that the animal can be approached without letting it see the hunter. The first thing he will do, then, is to watch it to see in which direction it is moving and how often the particular animal looks around. Then the Eskimo begins to follow it, moving along parallel, or taking a position in its line of travel. As he moves, he tries to hide or stand very still whenever the bear looks around, so that he can get in front and wait for it without being seen. While he does this he tries to stay on the seaward side in case the bear senses danger and flees, because polar bears always run in a direction away from the land. As soon as he feels that he is right in line with the bear's trail, the Eskimo hides in some rough ice and awaits the arrival of the bear, hoping for a side shot from the closest possible range.

If the bear happens to see his pursuer, if it is only wounded, or if the shot misses, it will almost always turn and run; and if it does the Eskimo will run after it. Relative to a man, bears are slower on flat ice, but much faster on rough ice. Many stories are told of catching up to bears, wounded or healthy, and killing them. But it was always noted that if they reach the rough ice no man can keep up with them. If the frightened animal does not sense the man well, it is best to wait in concealment before setting off in pursuit, because often the bear will go only a short distance and then stop to look around for a while or go back to its business.

Polar bear hunting is always done during the day so that there is good visibility for long distances. Only on the occasions when bears walk up close to the village or into a camp are they hunted after dark. On New Year's Eve, 1964, two men noticed that a dog was barking out on the ice at Wainwright, and they believed that a bear had come close and the dog had chased out after it. One of them went out onto the ice with a rifle and flashlight to look for it and found some tracks, but no bear. A Barrow native told of spotting one that was waiting at a seal hole in the middle of some flat ice. He could not stalk it so he waited in some rough ice. All through the dim early spring night the bear stood there, alternately lifting one foot after another from the ice and placing it slowly and silently back down. Finally it gave up and began to shuffle off, so he went ahead of it and shot it from 20 feet as it passed by his concealed position.

In this case, like so many others, the man had his dog team, and had to be careful to keep them quiet. Hunters hope to encounter bears when they are on foot so that they do not have this problem, or at least to be travelling with a partner so that one of them can remain behind to watch and quiet the dogs while the other stalks the game. If they plan to travel far out from the land, which they do when the west wind blows, two men will go with their dog teams, hoping to spot a bear when they stop to <u>nesisaaktok</u>, or scan with binoculars. In a few instances Eskimos have seen a bear on flat

ice while they were riding their dog sled, and have been able to run it down with their team, as long as it does not reach rough ice.

In the eastern Arctic today, and in northwest Alaska during the past, bears were brought to bay by dogs which were set loose from the team to chase them down (2). Several of the older men at Wainwright had owned dogs which they used for this purpose. Ikaḳ once had two dogs that he had "trained" to chase and detain bears. He would let them loose from the team after the animal was in plain sight. His father once used them when he shot two bears with a shotgun. This took place about 10 miles north of Icy Cape, where he was hunting sea gulls. He spotted a female bear with a yearling cub. First he stopped and tried to find a round stone to use for a slug, and finding none small enough he even tried to shove his ivory pipe stem down the barrel, but to no avail. Finally he took all of his shells and opened them, putting the shot from several shells into each of six which he chose to use.

He then released the two dogs, which brought the bears to bay out on the ice. After he caught up he waited for the proper moment and shot the large female with one shell, running back away from it immediately. Advancing again, he shot it once more, and it fell mortally wounded. He then pursued the yearling, which had run some distance away and was being harassed by a dog. This one he killed with a single blast.

Probably the most productive type of bear hunting is done in the fall, from late October until around Thanksgiving, at places where bears come onto the beach to feed on dead walrus or whale carcasses. This is normally the only time that congregations of several adult bears can be encountered, and the method of hunting is easy because the bears may be seen right in or from a camp. They also may be attracted by walrus meat, carried for dog food, placed outside. If the dogs begin to bark in the night, especially in the abandoned village of Atanik, it is likely that a bear has come close. The men run out with rifles, looking first at the tops of the sod houses, where the bears often stand to survey the situation.

The old man Ikaḳ probably has killed more bears than any man in Wainwright, and certainly holds the record for the most at one time. Many years ago he was driving his dogs along the coast near the Seahorse Islands. He left his team on the mainland and walked over to one of the low sandy islands, and as he approached them he saw two bears through his telescope. When he sneaked closer he saw not 2 but 14 bears, which were gathered arourd a dead walrus. He killed eight of these with seven shots, shooting two cubs at once, and let the others go because they were on thin ice and he feared losing them.

Kusik noted that when animals gather in large numbers such as this, they tend to lose their fear of man and can be closely approached. He once saw about 35 bears feeding on a floating whale carcass. He and his companions in an umiak shot 13 of them. These bears did not flee until shot at, and then after the shooting stopped they came back again.

Finally, there is a method of killing polar bears with a rifle set, which is now outlawed but was formerly used. The rifle was set into a hollow or snowbank, so that the bear had to reach its head in to pull at the bait, which was set to pull the trigger when the bait was jerked. This method is never used now, but might be resorted to by a drift ice survivor who was facing starvation.

## Behavior Toward Man

The behavior of polar bears toward man is important to sea ice travel, because these huge animals have been known to stalk men and to charge a hunter who has wounded them. We will deal here only with the behavior of polar bears in this region, which probably differs from that of bears in other parts of the Arctic. For comparison, the works of Stefansson (7, 8, 21) are probably the most authoritative accounts, written by an experienced sea ice traveller who encountered many bears himself and had chances to observe their behavior in less inhabited regions. The experience of the Eskimos, documented here, should be highly reliable and practical information, but is limited to observations made close to an inhabited shoreline, where the behavior of bears may differ from that in uninhabited regions.

To the Eskimo the most probable danger is that caused by wounding but not disabling a bear. Because this is true, hunters usually try to get as close to the animal as possible before shooting, and to be sure to hit a vital spot. It is possible to get the best target by waiting until the bear has reached the most favorable position and then making a noise. This will make it stop, so that the best steady aim may be taken and the chance of a poor shot minimized. Eskimos also will not shoot a bear which has just come out of the water onto the ice, because they believe that bullets will not be able to penetrate the wet fur. They wait until the bear rolls in the snow, because otherwise it would be necessary to make a perfect shot in the eyes, ears, or anus. One man supported this statement with a case where he and three other men tried to shoot a bear that had just climbed out of the water. It took them about 15 shots, he said, until one man hit it in the anus and another killed it with a shot in the ear. They found that their bullets had penetrated only about a "half-inch" and then stopped.

They also say that, normally, there are three types of shots which are used to kill bears: neck, shoulder, and heart. The least favored is the heart shot, because although this shot is deadly, the animal usually makes a bursting run before it falls. With a caribou this run is not any danger, but with a bear it is likely to be in the direction of the report, which is a great threat to the hunter. Stefansson insisted that his men use heart shots, which is puzzling in the light of this fact. The Eskimos will usually wait for the best shot, often with dogged patience, even if the bear is charging.

There is a case of an Eskimo named Willy, who unexpectedly came face to face with a polar bear and shot it in the heart with a .22 caliber rifle, killing it after only a short run. The northwest Alaskans believe that bears are left-handed, and that if a hunter is charged he should wait until the bear is very close and then run to its right side. The left is so quick that it is harder to avoid a mauling from that side. When a bear does run toward a man, he will either wait until the head is up and then hit the neck or else shoot it in the hind quarters, which causes the bear to turn and bite the wound, exposing the neck for a good side shot.

The neck is said to be the most deadly shot on a bear, but a difficult one to make because of the chance of shooting too low and missing the bone. Perhaps the safest is the shoulder, where it is very easy to break the bones and disable the animal. If the bear is standing on its hind legs the Eskimo will shoot for the base of the neck. In pre-rifle days, bears were killed with lances, but the methods must have been given up very early because of the danger involved. One very old man, Takumik, was said to have killed a bear with a knife when it stood up on its hind legs, a feat which proved him one of the greatest of the old-time hunters. Female bears with cubs are, of course, especially dangerous. If one had to be shot, the adult would be killed first, because if the cubs were shot the female would certainly charge.

Not all wounded bears charge, and in fact it is probably a small percentage that do. During December of 1964 a Wainwright Eskimo shot a bear twice but lost it because it ran off in the darkness. On the other hand, a young man took a long shot at three bears just offshore from Wainwright, wounding one, and was chased back to shore before the bear relented and ran away. In this case the man shot from too great a distance and when the bear charged, his gun jammed. Fortunately, he was close to the village. The fact that bears will sometimes stop charging and run away was established by another incident several years previous, when a man got up and ran toward a charging wounded bear, which caused it to stop and try to escape.

The behavior of non-wounded bears is generally one of great timidity. Whether they are watching a man from a distance or are suddenly confronted, they almost always run away. However, a hungry bear, and apparently only a very hungry one, will approach a man, mostly for the seals or other meat he is carrying or has in camp. Bears also follow sled tracks, but whether it is just a preference for walking a "beaten" path or searching for a meal was never stated. A few cases of bears approaching men will be listed here, but only as infrequent exceptions to the general behavior pattern. The ice traveller must, however, prepare for such an eventuality.

Men who have caught seals and are dragging them home on foot are especially wary of hungry bears. In the evening time it is more likely to happen than during the day, that while the man trudges along with his load dragging behind him, he may feel a tug on the line. If ever this happens he will slip the strap of the line off his chest quickly and grab his rifle in case it is a bear pulling on the seal. Brower (14) describes an actual case of this in Barrow, where the man had no time to grab his rifle so he thrust the sharp pick of his harpoon into the bear's brain, killing it. Another man who still lives in Barrow was bothered by two bears as he tied seals onto his sled. He was evidently in considerable danger, but killed both bears with his rifle when they were very close.

In a few cases bears have come into whaling camps in daylight with men walking around in plain sight, but these were starving bears. And a story was told of an old man who was walking along and was chased by a very skinny bear, which he dropped with a single shot when it was only 20 feet away. Only one other instance was recorded of a bear walking up to a man when there was no meat around. In this case a man was setting traps and carried only a knife. This brave fellow noticed the bear coming up on him and turned around, walking toward it with his knife drawn and telling it to go away or he would cut it up. The bear retreated, but followed again, each time being confronted in the same way. The man finally made it safely to Barrow village.

It appears that confronting bears in this way will usually scare them off, if it must be resorted to. Nelson (2) recorded a case where a man was approached by a bear, and lay down on the ice hoping the bear wouldn't notice him. The bear sniffed of him, but then heard the noise of his partner and ran over to the other man. The other man was killed and partially eaten.

This is the only case which the writer has found, besides one other in the literature, where a man was actually killed by a bear. Only one informant mentioned a case where a man had been hurt by a bear, while the others could not recall any such injuries. Perhaps a classic story of

confronting a bear and escaping injury was the one originally told by Ekok at Wainwright, and recorded in the author's field notes:

> Once, within remembered times, a woman was walking south along the beach across the inlet from Wainwright. She was walking to a place to collect beach coal. She noticed a polar bear walking toward her, and finally as it came nearer she stopped. She did not run because she had been warned that if you did the bear would give chase and 'play' with you, and probably kill you. As she stood still the bear came nearer, eventually walking right up to her. She held her ground, and when the bear finally came right to her and opened its mouth to bite, she used her only defense--her mittens... She jammed her hand down the bear's throat as far as she could, and pulled it out before the bear could bite down, leaving the furry mitten in its throat. The bear immediately began to choke and forgot about her in its efforts to breathe. Finally it lost its strength and suffocated.

It should be mentioned here, before moving on to the aquatic mammals, that polar bear liver is never eaten by Eskimos or fed to dogs. To do so will in some cases cause vitamin A poisoning, which is often fatal and causes severe illness. Other meat of polar bears is highly favored, and is boiled before eating. Nowadays the skin is stretched to the greatest possible dimension, cleaned and sold to outside buyers. If a bear is shot too far out on the ice to bring in the meat, the hide is folded into a small bundle and pulled in to shore. As long as the hunter has his dog team some of the meat can be taken, and perhaps all of it retrieved on a second trip. But there is no question that the hunt for bears has become more a cash occupation than a means of obtaining food.

## XV

## WHALES

### Beluga Hunting

The only whale found in this region which can be hunted by one man alone is the white whale or beluga (Delphinapterus leucas), called sisuak in the Eskimo language. Although they are occasionally taken at other times, these small whales are hunted mainly during spring whaling. Belugas arrive ahead of the first large whales, appearing in early or late March at Wainwright. This is not a large animal, running little over 15 feet in length and weighing about 1,000 pounds. But belugas may be seen in tremendous abundance during their main northward migration in spring,

when they are in sight constantly every day for up to a week. After that the numbers trail off and groups move northward through the open leads more and more sporadically.

As these whales move along in the lead the noise of their breathing is heard far ahead of their appearance. The short but very strong puffs cannot be mistaken for any other sound and resemble only the much longer and deeper breathing of the large whales. The Eskimos in whaling camp listen for the blowing of sisuak, and when it is heard they run for the high ice-pile lookouts to try to spot the herd as it comes closer. When it does it is recognized by the bright white or gray bodies rolling over in the lead or in open holes, periodically appearing for a moment to breathe a few times, then disappearing for several minutes as they swim along beneath the surface.

If they arise in the lead close to a hunter or near a whaling camp, the men station themselves close to the edge of the water, preferably among some piled ice so that they won't be seen. Belugas have a whistling call which warns of danger, and when it is given all of them in the area will dive and resurface far up the lead or in another hole. This is the main reason they are shot from the lead edge and cannot be chased with boats. They can also detect the noise of feet moving around on the ice.

Another thing which makes the beluga a very difficult animal to hunt is the fact that it is a fast swimmer and presents only a small target for a few seconds at a time. Hunters hope for a head-on shot, because then they do not have to move the rifle, but usually they must settle for the side shot. First, they watch for the light form just below the surface, indicating that it will soon rise. Once it surfaces, they must shoot immediately, aiming for the head. It is possible to shoot at the back also, but this only wounds the animal.

## Use of Retrieval Hooks

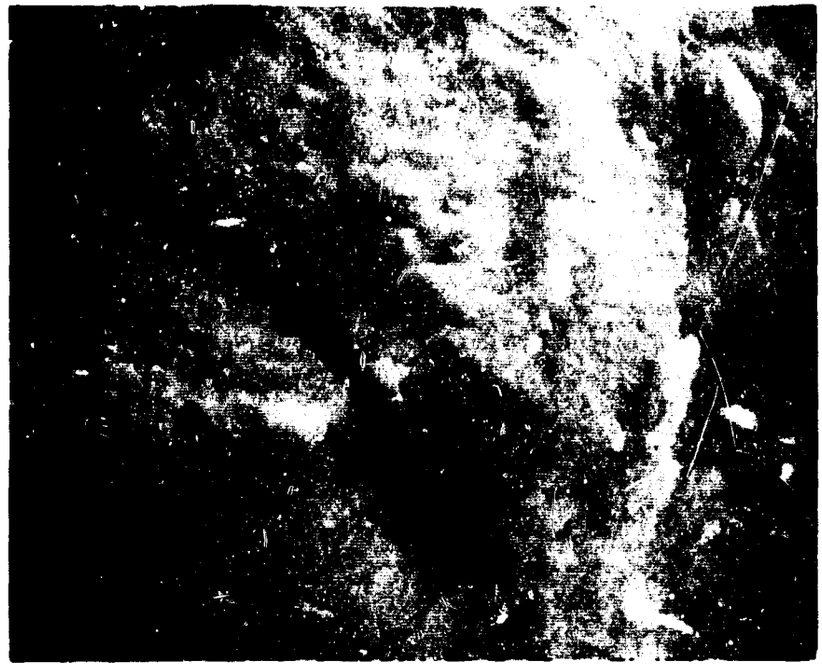
To add to the difficulty of shooting the animal, there is also the fact that when killed most belugas will sink immediately. Some of them do float, especially in the early spring. The gray ones, which are supposedly the young, will float more often than the white ones. Also, females, especially those with young ones inside of them, will float more frequently than others, but there is no method of identifying them from the surface. The best chance is probably to shoot for the gray ones and hope that they might float. When they do, it is simple to retrieve them using either a boat or a manak. If they do not float, they are probably lost, but the men will sometimes spend an hour or two attempting to hook one with the niksik, a sinking retrieval hook.

The niksik consists of a long line, perhaps 60 to 70 yards in length, (35 fathoms, measured by outspread arms, is recommended) with several hooks tied to one end, and a small lead weight attached beyond the hooks. The line is made from cotton cord, and is carried in a neat coil. The hook consists of an oblong piece of brass with two holes drilled through it at right angles. Pieces of metal rod or spikes are put through the holes, bent, and sharpened to form four hooks. The heavy lead weight, several inches long and an inch in diameter, is attached to the five-inch-long hook by a swivel. The line has a toggle placed three to four feet up from the hook, by which it is swung rapidly around, thrown as far out from the edge as possible, and then dragged in over the area where the dead animal is supposed to have sunk.

The manak is constructed in much the same way except that it has a pear-shaped, egg-shaped, or oblong wood float (igiłlhaq) attached to the far end of the hook. The manak may have a weight of ivory with metal barbs put through it, or may use a manufactured triple hook. It may also have three or four sharpened nails protruding out around the circumference of the float, bent forward to serve as hooks. This type may or may not have a hook in front of the float. The manak is variable in its construction. Some men prefer to use very oblong floats longer than the usual five to seven inches, with hooks on them, or a piece of 2 x 4 which floats flat in the water and therefore is more certain to get the hooks, placed on the flat edges, into the floating game.

The manak line is the same length, or somewhat shorter, than the niksik line. In both cases the line is often dragged along on the ice behind the dog sled or walking hunter to try to stiffen it and make it less easily tangled. The three- to four-foot length of line above the float or hook is either braided cotton line or, preferably, bearded seal hide thong. This part of the line must be very strong because of the tension put on it during seal retrieval. This line also has a toggle on it so that it can be held with the fingers while being swung preparatory to throwing. Some manaks have special floats with a cylindrical-shaped end and rodlike "handle", and three hooks around the circumference of the end. These are used for thin ice retrieval, evidently because they break the thin ice and are also less likely to become caught and be lost.

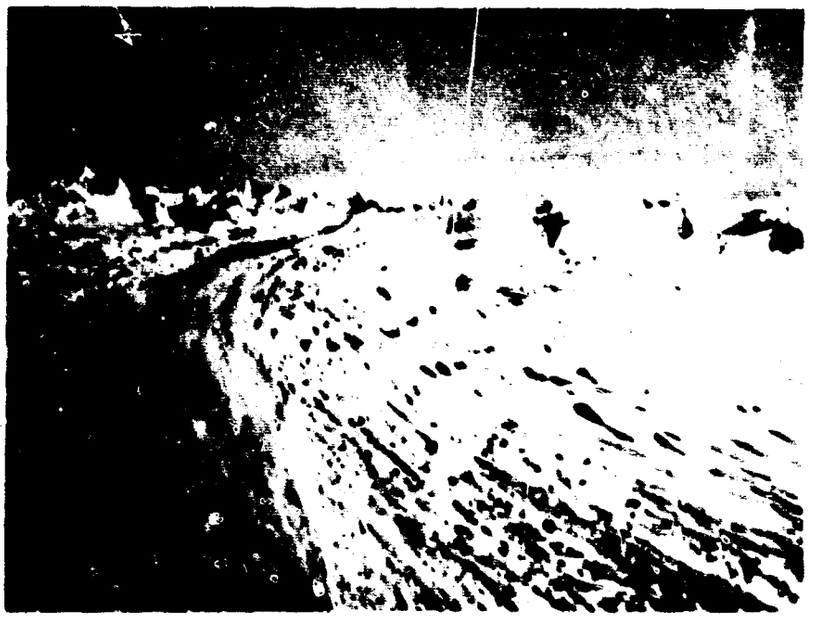
Retrieval of killed game, such as belugas or seals, with these hooks is a skill acquired only by long usage. It is difficult to throw them a long distance, and to do it with accuracy. There are experts who can throw them to the end of the 60-yard line and have them land with the cord passing right over the body of the animal. The line is then pulled until the hooks touch the skin of the game, and it is given a sharp tug, sinking them into the skin. The animal is then pulled slowly in until it reaches the edge of



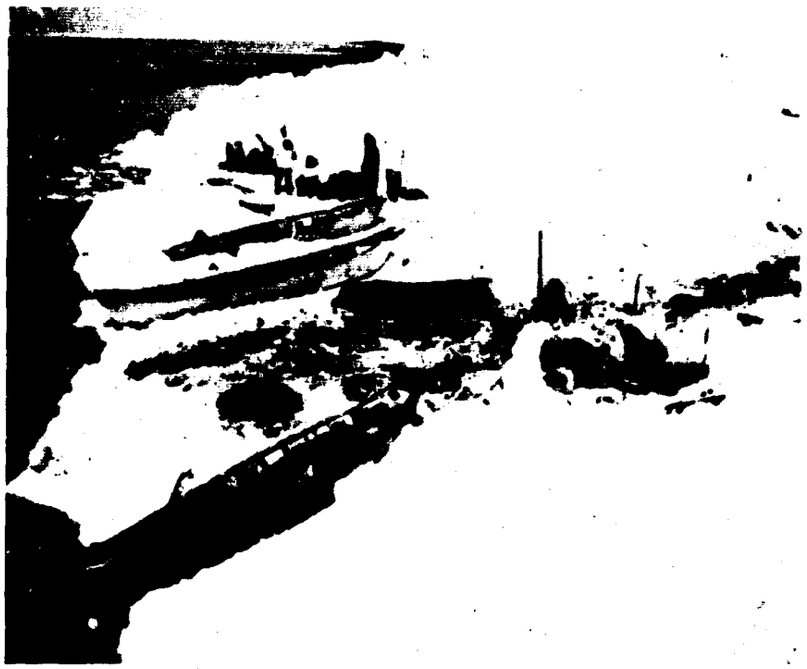
A niksik, or sinking retrieval hook, in use at Point Hope, Alaska. The 35 to 50 fathom line is not shown in this photograph.

A manak, or floating retrieval hook, in use at Wainwright, Alaska.

An umiak which is rigged for whaling, along the lead edge near Point Hope. The harpoon line is attached to the sealskin pok, which is located near the middle of the boat.



A dog team trail on the sea ice near Point Hope.



A whaling camp at the edge of the landfast ice near Point Hope. The ice apron is in its early stage of development.

An umiak being used for whaling at Point Hope.

the ice, and is hauled up with the sharp hook at the end of the unaak, or ice tester. If the current and/or wind is offshore, a man must be a sure shot or his game will float out of reach and be lost.

There are three ways to swing the manak or niksik preparatory to throwing it. The close targets can be reached by giving the line a couple of underhand swings and then releasing it. For longer tosses a circular vertical swing may be used, rotating the line around several times with a wrist motion, arm bent sharply so that the hand is equal to and slightly behind the shoulder. A quick and somewhat larger swing of the hand is given as the line is released. The farthest tosses are made by swinging the float or weight horizontally over the head, also rotating mostly by wrist action. This is followed by a tricky release, which makes this method the most difficult to master.

Once the line is let fly it can be guided so that it falls over the game and not to the side. If the line is coiled, which it usually is not for the toss, it is held in the left hand. One hand is always used as a guide, letting the line slip out through it. Usually the line is laid on the ice loosely coiled so that it cannot foul as it is paid out. The thrower runs to one side or the other as the line hurtles out, in order to assure an accurate landing of the cord over the game.

If he misses there is not a moment lost. He bends over and reels the line back as rapidly as possible, tossing it loosely onto the ice. Then a second or third shot may be taken, until the game is snagged or drifts out of reach. The Point Hopers are considered to be the best manak and niksik tossers, especially in the past, when they depended entirely upon this method of retrieval. Some men are considered experts today, and seldom miss even the farthest tosses. Traditionally the young hunter would practice throwing his line over targets put out on the ground, so that he would not miss game when it had been killed by his bullet. The retrieval hooks are used for snagging belugas, seals, walrus, and waterfowl, as well as for self-rescue practices described previously. The history of the use of these retrieval devices and use of skin boats for retrieval will be discussed farther on in this paper.

## Saugssat

Before moving on to a brief discussion of methods of taking the large whales, there is one phenomenon which should be mentioned. Sometimes herds of belugas are trapped by the moving and closing of the ice and cannot find enough open water to breathe. This happens in this region when the ice moves in to cover a lead, and perhaps occasionally due to the

freezing over of open water. Belugas, unlike the large whales, cannot break through the ice to breathe, and are therefore caught in a desperate struggle to find open spots in which to get air. At such times there may be hundreds of them crowding and literally fighting to get into the open spaces.

This is apparently not very uncommon in the western Arctic, but was reported to have happened only once in recent years at Wainwright, and once in Barrow. Tagazuk, a man in his early 30's, has seen it happen about 15 miles south of Wainwright. It was during April, when the first belugas were arriving, when three men were guided to the saugssat (as it is called in Greenlandic Eskimo) by the frantic hissing and blowing of hundreds of the whales at some holes along the edge of a closing lead. They shot seven belugas and retrieved them, and then headed off to Wainwright for the other men.

The hunters from the village eagerly headed south. Tagazuk said that he heard the noise while he was still far off, and soon he saw the churning bodies around a large hole. As soon as everybody arrived they began to shoot, some of them finding smaller holes and waiting there. He waited at one of these until a gray-colored whale arose and shot it, hoping to kill one that would float. He had to cut a hole in the flipper of the dead one and fasten it through the ice with his belt so that it would not be lost, and then he killed another. In all about 30 were shot and retrieved, being hooked with the manak if they floated and then tied to the edge to be pulled up later. The ice finally opened up and the rest escaped. It took the men many trips over the next few days to haul the meat back to the village. Unfortunately for the natives, this does not happen frequently enough to add significantly to their overall economy. The skin and meat of belugas are relished as food.

## Spring Whaling

But no food is more desired than the maktak or black skin of the baleen whales (ahġavik). These monsters, reaching over 60 feet in length and and averaging a ton per foot, can supply a considerable amount of food for men and dogs, especially if the season is a good one. At Barrow in the fall of 1964 ten whales were taken, and three more during the following spring, so that the people filled their underground storage cellars to capacity and had to pile whale meat and maktak outside of their houses. But there are also years when only one whale is taken at Barrow, and when divided among several thousand people this does not go very far. At Point Hope there are in modern times one to five whales taken each spring, the only whaling season. And at Wainwright whaling is becoming a lost art, so

that with only token efforts put forth each spring and fall there have been no whales taken for five or six years and very few in the past 15 or 20 years. Two were taken in the spring of 1965.

Whaling demands a great effort and expenditure of time and wealth on the part of every person in the village. In order for whaling to be highly effective, the entire spring season, April through June, must be devoted to the maintaining of whaling camps. Even when no whales are taken there will probably be a fair harvest of belugas, and some seals, as well as waterfowl. But if there is no whale by June the season is considered a failure; and that it is, because the expenditure far exceeds the yield if no whale is taken. People are naturally impressed by the fact that 60 tons of whale may be taken in an afternoon, but more often it is a small whale, divided among many. The resource is potentially great but sporadic with comparison to "everday" game such as seals, caribou, walrus, and waterfowl. How significant whaling is to the total ecology of the settlements is up for question, especially in modern times when it is degenerating even in its greatest stronghold at Point Hope. Whaling involves hard work and long cold nights for the crews, expense and effort with the hope of prestige for the umailik, or crew head.

A thorough description of whaling is beyond anything but a book-sized report and a several years' study, which it deserves and almost demands, lest it be lost from memory without extensive documentation. It is beyond the scope of this study to give anything but a very general description, especially since the emphasis here is on sea ice survival practices rather than this type of communal enterprise.

Whaling begins at Point Hope some time in the latter part of April, depending upon the condition of the lead and the time of arrival of the first whales. At Wainwright the first whales are seen in late April at the earliest, but usually not until early May. The large whales are able to break through fairly thick ice to breathe, and are therefore not in danger of drowning if there is no open water. There are several "runs" of whales which are separated by brief lulls, so the whalers plan on perhaps a week of heavy activity, during which they must be continually on the alert, and then a few days when not many whales are seen. At Point Hope there are three main runs, the last one usually finishing early in June, just before the crews come in for good.

Whaling activity is dependent upon the condition of the ice and weather. At Wainwright the whaling is not good because leads do not open as readily as round the points, and because the village is in a bight so the whales usually pass far offshore. At Point Hope whaling is excellent because the animals pass very close to the land, and during the spring there is almost

always an open lead. The lead preferred for whaling at Point Hope is one off the south shore of the spit, which is held open as long as there is a northerly or easterly breeze. South or west winds close the lead here, as at Wainwright, and temporarily end the whaling. Strong winds from any quarter also send the crews to the land, hauling their boats and equipment, wary of the ice breaking away and unable to chase whales in the rough water. Nothing is left on the ice at such times lest it be carried away and lost on the drift ice.

The best leads for whaling are fairly narrow ones, such as are caused by wind blowing parallel to the coast. This condition forces the whales into fairly narrow areas and allows the whalers to approach them more easily. Whaling camps are reached by trails chopped through the rough areas so that the umiaks, towed by men and dogs and lashed on heavy sleds called kamoti, can be easily hauled. In 1965 there were two main camps along the lead at Point Hope, with six boats in one and five in the other. The boats are set right at the edge of the lead, 5 to 50 yards apart, in ramps chopped almost to water level. The bow of each boat hangs over the water so that it can be quickly and silently slipped into the water when a whale rises somewhere nearby.

Around the boats are windbreaks made with snow-blocks or pieces of canvas, with shelter "benches" made from the kamoti with caribou skins on them for warmth and softness. Nearby there are ice piles on which the men can stand to watch for whales or make other observations. Behind the ice edge there must be some flat ice, an area large enough for the camp of each crew, for the dog teams used for transportation to and from the village, and for butchering whatever game is taken. Each crew has one tent, which is used to shelter the women and boys who do the cooking inside and, to some extent, for sleeping. When a whale is killed, the entire area around the camps is covered with meat and blubber, divided and sorted according to the shares for each crew.

In former times there were many restrictions during whaling, allowing no use of tents, no cooking, no changing of clothing; and so on. The men were then forced to wear clothing of maximum warmth. Of course these restrictions on comfort and leisure also kept the men in the camps and away from the village, and also made for greater alertness and organization. In modern times this discipline has broken down, but there is still little use of sleeping bags, although a man may pull one over him as he catches some sleep in the tent or behind the windbreak. The men also go back and forth between the village with dogs, although somebody is always watching for whales day and night. And certain of the restrictions, such as maintenance of silence when there are whales sighted nearby, are still followed to some extent.

During the long chilly night watches, it is mostly the younger men, under 30, who stay awake. They spend much of their time standing around watching the ice and water, walking to keep warm and occasionally conversing. When murres swim close they are shot at with small bore rifles. Periodically each man sits or sprawls on one of the benches to rest or sleep, but the cold has him up shortly, walking, stamping his feet, or clapping his hands to warm up again. The warmth of the sun in late morning, after these cold nights, is welcomed.

The quiet of the night watch, or the activities of the day are broken instantly if a whale is sighted or heard. Everyone stops what he is doing, runs to the edge and to the high places, straining to spot the rolling black back of a whale or watching the activities of another crew to the south which has gone out in pursuit of a whale. If the whale is seen far from a crew which set out after it, and closer to another crew not yet in the water, or if an unpursued whale rises close to a camp, the men run for the boats. With an ordered efficiency the boats are filled and launched so rapidly and quietly that a person who receives the word a moment late will be watching from the ice rather than in his place with a paddle. There is no shouting, no commotion, as the crews come running in answer to hushed commands and hand signals.

The only men who are absolutely essential in order to chase a whale are the harpooner, stationed in the bow with the darting gun at his right side, and the helmsman, who sits high in the stern and guides the boat. Thus it would be possible for two men to kill a whale if it surfaced close to them. But usually there are paddlers, four to six of them, stationed in pairs along the sides, stroking as hard yet as quietly as they can. Of these the only one with a special task is the one right behind the harpooner, who tosses out the sealskin float (pok), which is attached to the harpoon line, if a harpoon is tossed.

The crew pursues a whale, generally, but not necessarily, from behind. When they close in on a whale which has risen to the surface to breathe, they have from 5 to 30 seconds to get within harpooning distance before the whale submerges and moves on ahead, to rise again in a few seconds or, if it has filled its lungs, not for several minutes. The boat is paddled swiftly up along the left side of the whale, so that the harpooner can thrust the harpoon into a vital spot with his right hand. If the whale has risen in an open hole in the ice it will remain there, more or less stationary, while it breathes. But if it is in the open lead with clear water ahead, the whale does not slow down to breathe, but simply rolls over and blows several times in succession before submerging again. Occasionally a whale will rise to the surface without blowing, showing its back above water only once and not coming up in that area again. The men will remain in the boat out

in the lead or next to the edge, for 5 to 15 minutes after a whale has been spotted, awaiting a possible reappearance.

Whales are harpooned with a darting gun, consisting of a metal toggling harpoon and an explosive bomb. As the harpoon, with line and float attached is driven into the whale, the "bomb" is shot into the whale by a triggering mechanism and it explodes inside. An extra darting gun is usually carried, but without the harpoon portion, so that a whale that has been wounded can be "bombed" a second time by the same crew. Several "bombs" may be needed to kill a whale. Before darting guns were introduced, only the harpoon was used, and the whale was dispatched with lances. During the fall of 1964 at Barrow a whale was secured with the harpoon alone by a man from Wainwright. This man said afterward that he had listened carefully to the old man Takumiḳ, a great whaler, who had taught him the correct places to wound a whale mortally.

Once a whale is killed, its huge carcass must be towed by paddling to the edge of the ice, and then pulled up on it with a block and tackle. The whale may be flensed as it is pulled up or, if it is a small one, it may be pulled entirely onto the ice. It may take over 24 hours to butcher the monster, and another day to haul all of the meat and maktak to the shore. Individual whaling boat captains who are now old are proud of the number of whales they have taken. At Point Hope the old man Ḳimiraḳ had killed 23 in his life, and Takumiḳ who died at Wainwright in 1965, had taken 17. Each man had aided in the killing of many more.

Fall whaling, done at Wainwright, Barrow and Barter Island, uses most of these techniques but is carried out in the open sea before the arrival of the ice. At these villages the whale is first struck with a "bomb" from the shoulder gun, and then must be approached and harpooned to secure a line to it. From Wainwright the crews, one or two at a time, made excursions 20 to 40 miles north of the village to pursue the whales as they passed close to the land. In the fall of 1964, the Wainwright whalers were not successful, although a whale was struck with a "bomb" and lost.

## XVI

## WALRUS
## (Odobenus rosmarus)

The walrus is a huge animal, weighing over 1,000 to 2,000 pounds, which occurs along the northwest Alaskan coast during the open water season, but never is far from the drifting ice floes. They arrive in the spring, usually being seen first from whaling camps, where a few are shot.

Throughout the summer they are hunted by men of Barrow and Wainwright, where the pack ice often stays close to the shore. At Point Hope they are hunted in early summer as they migrate through, but are not seen after the ice is gone. During the fall, walrus migrate south along these coasts, but are not hunted unless there are ice floes around.

The method of hunting walrus, or aivik, depends upon the use of the large skin umiak. Walrus are normally hunted only when they are hauled up on ice pans which make up the drifting summer ice floes. The hunters go out from 1 to 20 miles searching for the basking herds. When one is sighted, they approach it deliberately, using outboard motors at least until they are fairly close. The walrus usually do not concern themselves with the intrusion until the shooting starts, and even then they may be slow about moving. Thus the boat approaches very close to the herd, and when the men begin shooting there is little chance of missing. Good hunters do not shoot hap-hazardly, however, but shoot one walrus at a time as they raise their heads. This causes less alarm and allows a greater chance to get a large proportion of the group. Unfortunately those which are not shot behind the eye or near there flop into the water and sink like a stone.

Formerly there was no chance of such loss because the animals were first harpooned and then lanced or, in later years, shot to death. Now the men shoot first and then harpoon to hold or retrieve the mortally wounded or killed ones. Walrus are seldom, if ever, shot while in the water, although the Siberian Eskimos did so formerly. However, the men tried only to wound the animals so that they would not sink, then harpoon them (22). When harpoons were used for the initial strike, they might be thrown from the boat, or the men would get right onto the ice cakes with the walrus and then sink harpoons into their thick hides.

In the fall, during September and October, men walk the beaches early in the morning looking for walrus. When the first snows cover the sand, groups of walrus will haul up onto the beach, and can be approached to within a few feet and shot in the head. In regions to the south the Eskimos used to drive them up onto the beach by using a baleen "clapper", striking the water from kayaks seaward of the herd to frighten them ashore. They were then harpooned after the men jumped out of the boats onto the land. The story is told of an old man who attempted to mount the back of a walrus on the beach and kill it with his knife. He was nearly dragged into the deep water and drowned by the animal, which caught his legs with its flippers and slowly moved out with the sea. The man, frightened almost into insanity, was finally released.

Native attitude toward the walrus is perhaps personified by this story, for these animals are regarded as being mysteriously intelligent and

malevolent toward man. They are able to understand when people speak of them whether they are nearby or far out in the sea. With this in mind a man does not speak of his exploits with walrus, whether it be something he has done or something he plans to do in the near future. "Walrus are like people. They hear when you talk and if you brag maybe they will get you for it. Walrus are mean, and can break the ice to get you or maybe grab you or sink your boat. If they try to catch you on top of the ice, drop the brass from an empty cartridge in the water. Or if they try to crawl up at you, shout at them to go away and say 'that's enough', and wave your arms. You have to watch close when you hunt walrus."

Several cases were recalled where a walrus had thrust its tusks through the bottom of a skin boat, or had hooked them over the gunwale. In the latter case it is best not to shoot, because in going limp the bulk of the walrus might tip the boat over. Instead, the animals are prodded in the whiskers until they slip back into the water. In spite of these dangers, the natives of Wainwright shoot 150 to 200 walrus each season, which normally serves as dog food for the entire year.

It is said that in some years a few walrus stay in the north all winter long, evidently breathing in the open water spots and perhaps crashing the young ice open with their iron-hard skulls to make breathing holes (11). Such holes are, however, rarely seen, and it is difficult to imagine how the animals find spaces to breathe, and yet the Eskimos very firmly state that walrus are sometimes able to do so. One of the difficulties of working with a native oral tradition is discerning which pieces of information have a foundation in actual fact, which are based upon a single atypical occurrence, and which have been based upon tradition alone.

When walrus do remain in the area all winter they are believed to feed on seals, and are for this reason responsible for the frightening away of seals and killing of those which remain. Therefore if a man spots a walrus during mid-winter he always shoots it whether he can retrieve it or not. However, apparently most winter-killed walrus will float and can be retrieved by boat, or manak if they are close to the edge. These winter walrus will also supposedly try to "get" a man if he stands too close to the edge and, if they are very hungry, they also pull birds down from beneath and eat them.

Because walrus apparently eat seals and sometimes remain all winter in the north, it is feared that a man pulling a seal back to the ice edge behind a small skin boat could be upset by a walrus grabbing the seal. When a seal is retrieved it is pulled back to the ice by a metal hook, called a niksiquarak, with a fathom of cord attached to it. The hook is stuck into the head flesh of the seal and the cord is held between the man's teeth, so

that if a walrus should try to pull the dead seal the line can be released and the boat will not upset. At least one living man at Barrow had this happen to him. Others have been saved from upsetting by releasing the cord when a ringed or bearded seal they were towing began to struggle, having been only wounded or knocked out.

Hunting the walrus or any other game, and travelling in this trying environment, demands that the hunter accumulate an intricate knowledge of the weather, ice, and animals. Successful hunters who are now old men learned their skills initially from their elders, not only by listening to their stories and advice, but by accompanying them out onto the ice to hunt. The young man was taught not only by his father, uncle, and grandfather, but also by the old men who talked in the gathering houses, or kazagi. "Formerly a young man seldom hunted by himself until he was 25 years of age because of the dangers of moving ice and the necessity of becoming thoroughly familiar with ice conditions before hunting alone." (4)[3].

Young men built up their physical prowess and learned the physical coordination required not only by practicing skills such as throwing toy harpoons and playing hunting games, but also by practicing for the contests of physical strength which were played in the communal houses. Strong men were able to demonstrate their physical prowess by carrying heavy rocks and by besting the others in contests. These contests are still carried on today, but are held only at Christmas. At this time young men and older hunters divide into two teams and for a week they play the old-style games every night. These include foot races up to 15 miles long, finger pulls, arm pull, lifting weights, wrestling, and other feats of physical endurance and strength. In addition there are games of coordination such as high kicking, where a glove is suspended from a rafter and must be kicked with the same foot which is used for taking off and landing, or other games such as various kinds of distance jumps. By these means the young man of former years learned the skills that an Eskimo man needed, and suited his body to perform them.

## XVII

## SEALS

Of all the types of animals found on or under the sea ice, perhaps the seal is the most widely distributed, abundant, and reliable in its presence

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[3] Reprinted from Point Hope - An Eskimo village in transition by James Van Stone, by permission of University of Washington Press. Copyrighted 1962.

from year to year. This is probably the most constantly utilized food resource when all coastal Eskimo populations are considered, for although some live mostly on caribou, others on fish, and so on, only the seal is available to all of them in fairly large numbers. This pattern of utilization of seal probably has been disrupted less than any other also, although the methods of obtaining seals have altered markedly and have changed many aspects of the total ecology.

Along the coastal region being considered here there are four species of seals, of which one, the ribbon seal (Phoca fasciata) is so uncommon that it will not be discussed here. In addition, the harbor seal (Phoca vitulina) is rarely found near the ice because it follows the open water in its migration pattern. The bearded seal (Erignathus barbatus) is found year round in this region, but is only common during the spring, summer, and fall, when it is seen among the drifting ice floes. The ringed seal (Phoca hispida) is by far the most important of the seals, occurring abundantly whenever and wherever there is sea ice or drifting summer floes. This seal is the one on which the Eskimos depend for their winter sealing in this region, and throughout much of the Eskimo domain. In the discussion which follows, the ringed and bearded seal will be considered together, because the methods of hunting the two are essentially identical.

## Distribution and Occurrence of Ringed Seals

The ringed seal or netchik is distributed not only throughout the circumpolar coasts, but may be encountered far from shore. Stefansson (7, 8) probably overstated his case when he hypothesized the presence of seals, in sufficient abundance to support human beings, anywhere in the ice-covered Arctic Ocean except in places where the ice never moves enough to create open water. Although it may be true that occasional seals find their way to the central part of the Polar Sea, it is probably only during the summer period of maximum open water, and even then is an uncommon occurrence. During the winter it seems improbable that they are found more than 50 to 100 miles out, but the problem is evidently still awaiting study (23, 24).

Stefansson did not believe the Eskimos who said that seals do not live far out from the coast, an idea which is held as strongly today as it was in his time. Eskimos frequently state that seals cannot live too far out from the land because the depth of the water is so great beyond 30 to 50 miles. It seems that depth actually makes little difference because ringed seals do not need to reach the bottom to feed, and the organisms on which they live are found clear to the Pole.

Reading Stefansson's large work, The Friendly Arctic (7), one begins to doubt what he states regarding the availability of seals far from shore, because while he writes that he is in a desperate state due to lack of food, he also says that he and his men seldom had time to stop and watch for seals at a lead, and that when they did stop, they never did see any seals. Stefansson mentions, however, that every day or so he saw at least one scar in the ice, made by a seal breathing in young ice. He says this shows seals were there the previous fall, and if they were there in September or October, he feels sure seals would still be present in April.

The "scars" which he mentions are those caused when a seal thrusts its head through young ice to breathe. Several pages earlier Stefansson has told how fresh-water ice, formed near the Mackenzie River, had been moved 100 miles out to sea by wind and current pressures, but it seems that he feels that in the same period of time the ice which was scarred by a seal has not moved at all. Indeed it is possible that these marks were made but 10 feet from shore, or if they were indeed made farther out to sea the seals could have moved into the areas of thinner ice and greater ice movement for the winter period.

The first seal spotted by Stefansson and his companions was not seen until May 7, when the thaw had progressed so far that they were worried about being able to make it to shore before the following fall. At this time he was far offshore in the vicinity of Banks Island. After May 15, they saw abundant seals when they were 75 to 100 miles from shore, in water over 700 meters deep. This disproves the Eskimo's theory that the seals shun deep-water areas, but does not help us to learn if they are found far out to sea, especially during the winter. By the time Stefansson began getting seals there was no longer much formation of young ice, and open water existed throughout the ice on which he was travelling. His conclusion that he had proven the existence of seals everywhere else on the ice-covered Arctic Ocean is open to question.

The writer's information on this question is, to be sure, anecdotal, but may offer some hint as to the existence of seals far from the coast. Although they are not trained or intended to watch for seals, some men who worked on the Ice Island stations maintained by the Arctic Research Laboratory reported that as they did their studies on the ice they almost never saw seals. This in spite of the fact that open water is very often present at all seasons around the edges of the Ice Island, where the ice is opened due to the different rate of movement of the Island. Seals in open water are easily seen and identified, so that we can perhaps accept that seals occur only rarely in the areas which the Ice Island have covered. Since they have moved through great areas of the ocean, this includes a large territory.

Also, the fact that polar bears are very rarely seen indicates perhaps an absence of food in the central parts of this ocean.

Another piece of information, again anecdotal and drawn from only a single locality, is that of one of the Eskimos who was working during the winter at a temporary ice station some 100 miles offshore from northern Alaska. At this location, although admittedly much of the ice was flat and fairly undisturbed, this Eskimo saw only two seals in seven weeks, although he spent considerable time searching for them and is respected as one of the best seal hunters. Having been raised in the area of northeast Alaska where there is little open water, he is an expert at locating breathing holes, but was able to find only a few during this period, and saw one of the two seals at a breathing hole. Although this refers to only a single ice area, during the winter season, the findings of this native must be accepted as valid.

It is impossible to draw any conclusion from this little information without a search of the literature and perhaps awaiting further research. However, it seems safe to conclude that ringed seals are likely to be found in abundance only fairly close to the coast, and during the winter they probably move in toward shore and away from the regions far out in the sea.

The distribution of seals locally is of far greater concern to the Eskimos than their occurrence far beyond the Eskimos' hunting range. It appears from the comments of Eskimos that seals are most abundant where there is strong current, although this could lead back to the method of hunting them. Ringed seals are found, and hunted extensively (formerly, at least), in the great unmoved ice plains of central Canada. Closer to the region being studied here, areas of undisturbed ice such as Peard Bay and the area north of Icy Cape are said to be "covered" with seals basking on the ice in late spring. Perhaps they move into such areas at this time because of the safety of sunning on flat ice, where they are most difficult to approach, but this is doubtful since there are many seal holes in this region all winter.

During the months when the ice pack moves offshore, the seals move out with it, both the ringed and bearded seals. In the fall they come shoreward with the young ice, but some bearded seals, or uguruk, migrate south. From November until late February or early March, ringed seals occur in open leads abundantly, but uguruk are not common. From March until June they are rarely seen in open leads, but increasingly are observed on top of the ice. After whaling season is over, the Point Hope people say that the seals are again found in the open leads, and the uguruk becomes more common. They are hunted here and along the beach until the pack

moves north. At Wainwright and Barrow ringed and bearded seals are killed in abundance during the summer walrus-hunting time as long as the pack is close.

At Wainwright there are ringed seals in the Kuk lagoon, especially during the fall, but they are not common. Fall sealing is done to the south near Icy Cape, when the kasegiak, or harbor seal, is found in abundance through September and October. Hunting is done by shooting the seals in the water or on the beach, and by netting them along the shore. It is only done haphazardly nowadays, but in earlier years the brants and harbor seals taken in the lagoon were an important source of pre-winter game. Following this was an annual "migration" to inland fish camps, where not only fish but also caribou were taken before the Eskimos returned to the coast for winter sealing. The autumn fishing has also decreased to almost nothing at Wainwright, although it is still important at Point Hope.

## Seal Netting

Seal netting is evidently no longer practiced in northwest Alaska, except perhaps occasionally during the summer when nets are set out from the beach in especially good places. The older men have all netted seals on the winter sea ice, and often say that they would like to instruct the younger hunters in the skill, but this is apparently never done. Netting requires physical hardship and danger, and even though it can give productive results there is little incentive to face these discomforts. It demands first, that the men go out on the ice during the darkest nights of winter, with no more than the light of the last quarter of the moon. This darkness brings the danger of being unknowingly rafted away from land on an ice floe. And second, it requires that men stay outside watching and working the nets on the coldest nights, without a chance to sleep or warm up.

Seal netting was supposedly introduced to these northern people by outside groups long ago, and before this all sealing was done with harpoons. By the time Murdoch visited Barrow, in 1881, seal netting was an important activity (6). There are basically two kinds of seal netting, vertical net and horizontal net. It was not learned which was considered to be the most productive, but it seems that the horizontal type would be the easiest to learn and to set up.

The vertical net resembles a fish net hung beneath the ice, but with a mesh measured to be the size of the circumference of a man's head. Three holes are chopped through the ice, one at each end and one in the middle of the net, and it is held in place by lines at the ends. The nets described by Wainwright Eskimos were not long, up to perhaps 20 feet for a large one

Weights are hung, one at each end and one in the middle for a long net, at the ends only for a short net. If there is no open lead offshore, the nets are set beneath smooth ice surrounded by hummocks, where there is little current. Perhaps this is because seals feed on organisms which congregate in places with little current and are most likely to become caught in the net there. It was not mentioned if netters are required to keep quiet for this type of set. As many as 40 seals would be taken in a night with vertical nets but half that would be considered an excellent take.

Murdoch (6) describes a method where the net is set about 100 yards from the edge of a lead. With this method it is necessary to attract seals by scratching the ice, walking around, or thumping, probably similar to methods which are used today for open lead hunting. This would bring the seals to and from the lead, hopefully intersecting the net and becoming entangled. Around Bering Strait a method is described whereby nets for seals are placed where seals pass close to points or headlands (2), similar to the sets made by Greenlanders.

The horizontal set is used when there is no open lead nearby and capitalizes on the seals' use of breathing holes. During the day a hunter locates breathing holes (allu) and remembers their location. Then in the dark of night he returns to an allu and chops four holes in the form of a square around the hole. With a long pole and line, the four corners of the net are attached through these holes and pulled up to the ice, leaving a sag in the middle over the opening of the breathing hole. Seal holes made in "wrinkled" ice with open spaces beneath, where seals crawl out of the water inside, are excellent spots to place such nets. Rising to breathe, or to crawl up into a hole such as this, the seal puts its head into the meshes and becomes tangled, causing it to drown. If a seal is caught and pulled out through an allu, the enlarged hole can be covered with snow, with a small hole in the center, so that other seals will return to it and perhaps be caught.

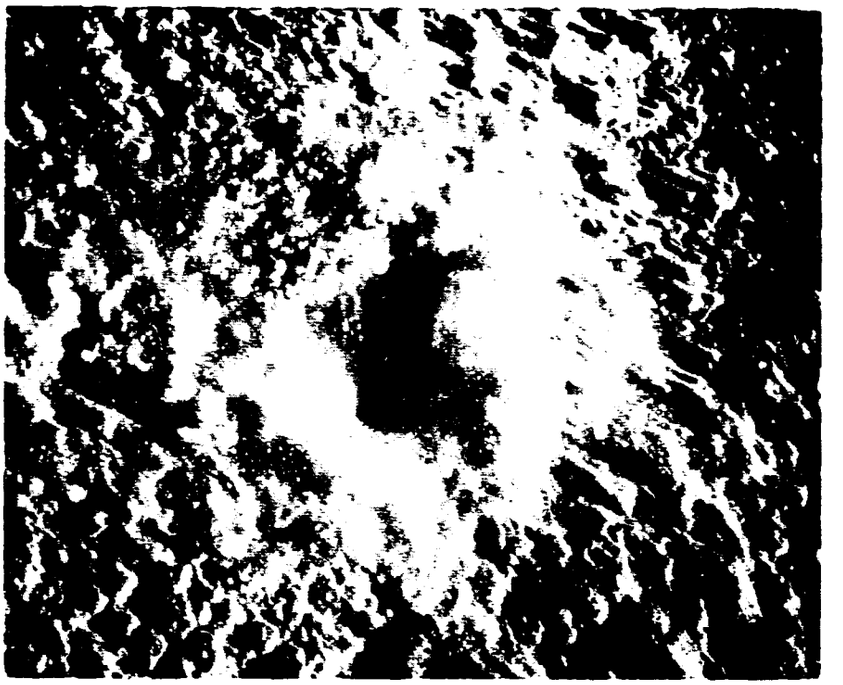
There is a tradition which states that seal netters may find that in the dark of night a strange creature with the head and face of a human has become tangled in their net. Hunters therefore feel of the head of their catch, and if it has long hair they know that it is a "merman". Should this happe. the hunter must lick his palm and then touch the creature again with that hand. If done properly he may catch many seals that night. A man at Icy Cape was said to have caught one and released it as one is supposed to do, but he did not do the necessary palm licking. A short while later he looked into his net and saw human hair in it. Reaching down to see what it was, he was nearly pulled into the water by the angered creature, because he had not done what was required. (For another version of the "merman", see reference [5], pp. 261-262.).

## Location and Characteristics of Breathing Holes

Several times previously it was mentioned that both ringed and bearded seals are able to make holes through the ice in order to live without depending upon rising in open water to breathe. These holes are started when the ice is just forming and is so weak that seals can break through it, leaving an open rough hole with a few small chunks of ice around it. As the ice thickens beyond about four inches they can no longer do this. They must either gnaw and scratch new holes or maintain the old ones in this way as they freeze over and can be kept open only as a small opening about an inch in diameter. The old head-holes that are left to freeze over will remain as "scars" on the winter ice, showing as little circles of ice chunks on an otherwise smooth surface.

The ice continues to thicken around the hole, but the seals keep maintaining it as they return to it, making the hole big enough to get their head up inside of the small ice "igloo" which forms over it. This characteristic dome-shaped or conical formation is created as the water sloshes out through the small hole each time a seal enters from below. It forms over the surface of the ice, so that to the ice surface level the hole is still large enough for the seal to fit its head through. When broken open, or if a man peeks in through the small opening, the circular hole is seen to be filled to the top with water, or frozen over if it has not been visited within a few hours. Beneath this surface structure the hole widens to accommodate the seal's body as it comes up inside. If the ice is only a foot thick this is not noticeable, but in five-foot ice there is a cigar-shaped "tunnel" leading upward. The holes uguruk, the bearded seal, are discerned by being much larger and having a tall ice "igloo" outside.

A single allu is often used by several seals, so that if one of them is killed by a hunter, he can come back some few days later and perhaps hunt the allu again. It is relatively simple to discern whether a hole is being used, because if it is there will either be open water inside or very thin ice, both of which make the inside look black. Unused holes will be gray inside, and clearly show that they are frozen over thickly. If the hole is difficult to see, such as those located inside of upward folded ice (which are also very hard to find), a small hole can be chipped with the unaak to get a good look inside. It must be carefully closed again with a small piece of ice or snow, so that the change cannot be seen by the seal. The hunter can shoot right through the thin ice if it is hard to get a clear shot. Another way to tell if the hole is in use, in late winter and spring, is by smelling it (without touching it). The male seal, or tigak, leaves a strong musty odor around it although the female, or aagansaluk, does not.



A typical allu, or breathing hole, in flat ice. The direction of the last previous wind is indicated by the small "drifts", with the blunt ends facing toward the wind.

An allu, or breathing hole, with characteristic build-up of ice surrounding the opening.

Seal holes may be very easy or difficult to find. On flat young ice the hole shows first as an elevated round platform, obviously formed by water pouring out over the ice, with a small hole in the middle. If it is a bit older it begins to be built upward to form the usual irregular dome shape. These are visible easily from 10 to 20 yards away, and are obviously seal holes. In winter ice this type will be found wherever there has been a crack or lead which has been closed with young ice. If the young ice has rafted, the holes will be abandoned.

In areas of rougher ice, where young ice has been "wrinkled" or "buckled", or along the juncture between winter ice and thin young ice, where there is an abrupt wall above the thin ice surface, seal holes are much harder to find. In these places they may be absolutely invisible and only can be found by breaking the ice open or using a dog to smell them out. But they may be betrayed by the characteristic buildup of ice outside, caused by water flowing and spraying up before the seal emerges inside. If the holes become snow-covered they cannot be detected without the help of a dog. It is not necessary in areas where the ice moves a lot, because holes can always be found in young ice with no snow cover, but in areas such as northeast Alaska and central Canada the holes are snow-covered all winter.

According to Stefansson (7) each seal has 6 to 12 holes. He states also that they abandon holes which do not become snow-covered because the holes freeze over too fast. This may be true in the Canadian Archipelago, but it definitely is not in northwest Alaska, although the ice conditions are sufficiently dissimilar to explain the difference in behavior.

## Traditional Method of Breathing Hole Hunting

Seal hole hunting is not done any more in this region except by older men at Point Barrow and perhaps occasionally at Point Hope. It requires a long and very cold wait, with a maximum yield of two or three seals in a very hard day's waiting. The modern method of rifle hunting at open water is so much more efficient and comfortable that the young men could never be persuaded to undertake seal hole hunting. Old men point out that at the allu there is never a need to use a retrieval device and little danger of losing the game once it is killed. For survival on drift ice the breathing hole method may be the best, but it requires no small amount of skill, great endurance, and considerable resistance to cold.

The pre-rifle method of breathing hole hunting is described by Boas (16) with perhaps more completeness than any other published account: The equipment needed is a harpoon, snow knife, piece of fur for a footrest,

piece of ice for a seat, two notched sticks for a harpoon rest, a seal-pulling harness, and a leather thong to tie the hunter's legs together on long waits.

The harpoon, or unanag, (in northwest Alaska called unaak) is a wooden shaft with an iron rod at one end and a stout iron point at the other. An iron toggle-head point is placed on the end of the iron rod, and has a line attached to it and affixed to the harpoon shaft with a slip-hitch, so that it will be held in position until the seal is struck. The stout iron point is used for chopping rough ice and making holes, and the iron rod is used to test snow depth and ice strength. The harpoon is set onto the notched rests, which are stuck in the snow alongside the Eskimo as he waits.

The hunter goes out by dog team to the sealing area, where he takes one dog from the team to find a seal hole. Once a fresh hole is found the dog is returned to the sled. A small peep hole is made to check whether the allu is fresh, and is then filled over again with snow, with a mark left to indicate its center. No hairs from the clothing must fall into the opening or the seal will smell them and be frightened away. Thick snow coverings are shaved down with the knife, but are re-covered with loose snow, heaped around the end of the harpoon, which is removed to leave a mark over the hole.

If the seal is expected to return soon (Boas does not explain how this is judged), the hunter stands on a small piece of skin and waits. When the seal comes he thrusts the harpoon heavily into the hole, striking the seal in the head or neck, and begins to pay out his line. The harpoon may become unattached from the line and fall into the snow, or may be pulled down through the hole and help impede the seal's struggles. The hole is enlarged so that when the seal comes up it is "easily dispatched" and the hunter then pulls it up on the ice.

If the hunter expects a long wait of a day or longer, he will make a snow-block windbreak and put down a block for a seat. A small piece of skin is placed on the ice for a footrest and his legs are held together by a thong. The snow knife is placed at his right and the harpoon, on the two rests, at his left, while the line lies coiled in his lap. The hunter pulls his left arm out of its sleeve. When a seal is heard breathing, the arm is carefully slipped back again, the coil and harpoon are lifted and the seal is struck. Seal indicators, thin bone rods which are stuck down into the hole and jiggle if the seal comes, are known but seldom used because they tend to frighten seals. One or two seals are killed in a day.

## Modern (Rifle) Method of Breathing Hole Hunting

The contemporary Eskimo of northwest Alaska no longer uses the harpoon for breathing hole hunting, but has devised a method of hunting with the rifle which may or may not be superior. The principle disadvantage of shooting seals at their allu is the fact that there is no line attached automatically and it is possible to lose the killed animal by sinking or having the current carry it away. The advantage is a sure kill, without the chance of having the harpoon head slip out or the line break. As noted above, few men nowadays do this type of hunting, but most of the men 50 years old or older have done it and are very knowledgeable regarding the technique. The writer was able to participate in hunting by this method twice, with a Barrow man who had used the method all of his life.

Hunting at allu can be done at any season, but is most likely to be used during the late fall or winter, when there is no open lead nearby and the seals have not yet begun to come up on top of the ice to bask in the warm weather. It is not impossible to hunt by this method if there is an open lead nearby, but most men consider hunting in open leads to be superior to sitting for hours beside a breathing hole. In case he has no means of retrieving a seal shot in the water, the man could go and find an allu nearby, because the seals always maintain them and will need them when the lead closes. Because this type of hunting is done in the coldest part of the year and because it demands a long quiet wait, the hunter must be dressed for maximum warmth. This means the best skin clothing, preferably caribou parka and pants, with fur boot liners and warm gloves. In lieu of this, down would be used, but is not preferred because after the long cold wait, caribou fur is easy to rewarm but down is not.

The equipment required is not elaborate. The rifle should be fairly heavy -- 30.06, .265, .243 or a similar caliber -- but if these were not available a pistol or a .22 caliber could probably suffice. In addition to the weapon, the hunter carries his white cloth parka-cover so that the seal is less likely to see him, unaaḳ to hook the seal and to chop the ice (a metal hook would suffice if it had a handle at least one foot long), pulling harness, knife, and rifle case. The rifle is usually carried in a homemade canvas or sealskin case, with an open end, which is slung horizontally by a strap which passes across the upper chest and allows the rifle to hang across the small of the back. The case often has loops on it, through which the unaaḳ is slung. If there are no loops, the unaaḳ is carried in the hand or by draping the arms across it to hold it across this part of the back.

The hunter arises early in the morning, usually before sunrise, and either walks or rides his dog sled out onto the ice. The only advantage of

using the dog team is that he travels faster and can bring the game home on the sled. Dogs, however, must be put 100 or more yards from the hole, and would frighten away a bear if it should come close-by. Arriving at an area where he knows the location of seal holes, or where he will probably find some, the hunter leaves his dogs and locates a hole which is being used and which he feels would be a good one to hunt. When he finds the allu that suits him, he checks first to see which way the seal will rise in it. This can be discerned by looking at the ice "igloo" to see if it is shaped narrower at one end than the other, and if the opening to the outside is a bit off center. The narrow end, and the area of the hole, is where the nose will be. The seal seldom rises straight into a hole, so the angle of the "tunnel" may also be noted. This way when he shoots, he will aim for the brain and angle the rifle a bit to correspond with the angle of the seal's body. In actual practice it would be very difficult to miss as long as the rifle is held straight over the hole or the ice igloo, so this trick is less important than some of the others. It is important, however, never to touch the hole.

Second, he checks the ice around the hole. If it is snow-covered there is little problem, and he can stand directly on the snow if he wishes. But if there is little or no snow on the ice, the seal would detect the dark shadow of his feet from beneath and would not rise in its hole. In this case he must use ice blocks to sit or stand on, or a little wooden stool. These stools stand only about 8 to 10 inches high, atop three tapered legs, and have a triangular seat not over 10 inches across. If he stands, he will face the hole and hold his rifle in his hands. If he decides to sit, the hole will be at his side and his feet will be up off the ice on a block of ice. This way he is seated with his legs straight out, supported above the ice by two ice blocks or one block and the stool, with the rifle laid across his legs. The unaak is stuck in the snow or laid atop a small ice block, within reach of the hunter. Its shadow also should not be seen from below.

The preparations are made quickly, the actions being almost automatic because the hunter knows what he must do, and that the more quickly he finishes, the better his chance of being quiet by the time a seal approaches the hole. In the placement of the ice blocks or stool, three factors are considered: (1) If the sun is shining, his shadow must not fall across the hole. (2) He must not sit upwind of the hole, but should be at a right angle, or at best, downwind of it. He also tries not to face the wind if possible. (3) He should try to sit in a position so that the seal will not see him through the small hole. This third factor is less important than the other two, and if the hole is larger than a 25-cent piece, a small chip of ice or snow may be placed alongside it (with a gloved hand) so that the seal's view is blocked. If the man stands this is probably more important.

Once the Eskimo has placed his stool and/or ice blocks, having found nearby or carried from elsewhere one or two blocks at least six to eight inches thick (snow-blocks could probably substitute), he seats himself. A piece of fur or cloth is placed on the seat if it is an ice block, and the rifle case is put under his calves or heels where they rest, to prevent their becoming cold. The rifle is laid across his lap, or across the upper part of his boots, where it is less likely to compress the clothing and cause chilling. The muzzle faces toward the hole, but of course does not overhang it. And the bullet is in the chamber, with the safety off. He has placed himself so that he is close enough to reach out over the hole easily, but not so close that he will be seen. Now he will wait.

The greater difficulty of the wait is not boredom or cold, but being unable to move the legs or sitting position for hours at a time. In some ways it may be easier to stand, because then the legs do not have to be held straight out in front, which stretches the muscles and makes the seat seem unbearably hard after an hour or so. Although the Alaskans do not seem to do it, the Canadian method of sitting with legs bent would appear to be the most comfortable. The only allowable movements are the arms, which permits smoking. A Barrow man was observed to smoke continuously during one four-hour sitting. But no move can be made which could transmit sound to the ice below, and also with this in mind the ice blocks or stool are set very firmly onto the surface so that no movement or rocking is possible.

In the silence of the sea ice, and after the boredom of the waiting, the arrival of a seal is startling and exciting. It may come as little as 15 minutes after the hunter begins, but normally it will take an hour, and often several hours. The Canadian Eskimos are known to sit by an allu for 24 hours, if it is a starvation period. The first sign of the seal's approach is pulsation of the water in the hole, and then a spraying or flowing of some water out through the opening caused by the seal rising in the narrow "tunnel" below. The seal may also scratch and clean the hole briefly. During this time the Eskimo is perfectly still.

Shortly thereafter the seal takes a short breath. It is only smelling the air and checking for any sign of danger. The hunter again does not move a muscle. He knows that this will be followed by another brief silence, but that the next breath will be a deep one. The first deep breath, the third part of the seal's appearance, will differ from the short scenting breath because it is much deeper and longer. The hissing is so loud that it drowns out other noises, so the hunter must now move. If he is standing he spreads his arms enough so that the clothing will not scrape and make noise, and he moves the rifle over the hole. If he is seated he also spreads his arms and moves them to the rifle, being also careful not to turn his

parka ruff into the wind if it is strong enough to hiss through the fur. When the breathing stops, the hunter stops.

On the second breath the hunter who is standing holds his rifle over the hole and shoots. If he is seated he may also move his rifle over the hole and shoot, but he probably will only raise it to a vertical position, holding the thumb of the upper hand on the trigger. On the third breath he quietly moves the muzzle over the hole and shoots. The rifle can be shot through the opening itself if this appears to be the best spot for a solid hit. Or it may be fired right through the thin ice of the "igloo" as long as the rifle is of a fairly powerful caliber. If the hole is inside of some buckled ice, the hunter may find it necessary to fire with the rifle at an angle, and he may also shoot through the ice. But in such a case the ice is likely to be too thick, so a hole is made with the unaak and a thin chip is placed over it.

When a seal is shot in the head it does not become instantaneously limp, but quivers and shakes briefly before relaxing. Therefore the Eskimo will hook it with his unaak immediately, perhaps chipping the hole a bit first if the hook is too large, and hold the seal until all movement stops. It is then pulled up into the hole so that a slit can be made through the lip and a line attached to it. This line is held beneath the foot while he chops the hole large enough to withdraw the seal. If the ice is thin the seal may be pulled away quickly by the current, so he hooks the animal very fast. In thick ice the seal is held, by its buoyance, inside the vertical "tunnel" and cannot be swept away. Only a few seals will sink during the winter.

In actual practice the northwest Alaskans rarely hunt a seal hole alone, but prefer to have at least one partner. This way one man sits and watches the hole, while the other walks around in a large circle, 50 to 200 yards away, to frighten the seal away from their other holes. This way the maximum wait should be an hour, and if the seal does not show up by then they search for another hole to hunt. If a man is alone he can also go around and either touch all other holes he finds or urinate on them, so that the seal will be frightened away from them. This is probably used only on smooth young ice, where there is a chance of locating most of the holes.

Among the northwest Alaskans it was considered best of all to have a group of three to eight men, so that they could search out enough holes for each of them, and attempt to station a man next to as many of the holes as possible. This technique has been used in recent years only when the leads were not open. In this way seven or eight men have each gotten a seal during a day's hunting. This same method is known in Canada, or in some cases even the women and children wait at holes just to scare away the seals that come up and force them to a hole where there is a man with a

rifle or harpoon. These methods are best used on very flat ice during the thaw, when every hole can be found.

## Calving Den Hunting

During the winter some holes become deeply covered by snowdrifts. In such places ringed seals may enlarge their breathing holes and excavate a hollow beneath the snow large enough for them to crawl out of the water and rest inside. In northwest Alaska it is also common that seals will open holes into hollow places beneath warped ice of ice piles, and use these for dens. Seal dens may be seven or eight feet long. They are often used by more than one seal, perhaps up to six or eight.

An important function of both kinds of dens centers around the birth and early raising of young seals. These silvery-furred babies must be born on top of the ice, and cannot swim for some time afterward, so must be kept in a place safe from predators. Foxes and bears can locate the snowbank dens by scent, and will break into them and eat the baby seal. In the eastern Arctic the Eskimos are able to find the dens and take the young and often the female, but in this region most dens are in rough ice and cannot be found.

Adult female seals were seldom shot in the open leads during the winter of 1964-65, and the Eskimos attributed this to the fact that the females tend to stay beneath the ice more and in seal "houses" in heavy ice farther out beyond the leads. The young are not born until April, however, so this does not seem to explain females using dens as early as January. Both males and females are very rarely seen in leads from March until the end of May, because they stay beneath the ice and shun open water. After this time they appear both in the water and on top of the ice.

Alaskan Eskimos in former times would go out to find dens, using a dog to locate them. When the dog began to "smell around" a drift or a likely place, a small hole was made in the side so that it was possible to look inside to see the location of the open hole, by which the seal enters. When the water began to shake and pulsate, the hunter knew that the seal was about to rise. As soon as the head came up inside, it was shot through the hole made in the outside wall. The old man who described this technique had taken ringed seals by this method in his youth. No mention ever was made of the breeding habits or use of dens by bearded seals.

In central Canada the hunters take dog teams out over the snow-covered sea ice and sit on the sled while the dogs scent out the cavities below. When the dogs smell a den and stop, the Eskimo jumps quickly from the sled and

breaks open the roof, hoping to cut the seal off from its retreat into the water. The female often escapes, but the pup is slow and may not even be old enough to swim. It is pulled out by a hook on a wooden shaft, and killed by having its chest stepped on, or may simply be kicked in the head. It might also be tied to a thong and dropped into the water, with the hope of attracting the female so that the Eskimo can harpoon it (16).

## Sleeping Seal Hunting

During the spring it is the habit of ringed seals and bearded seals to come up on top of the ice, either by enlarging their breathing holes or by emerging through narrow cracks. Actually, although most basking is done after late May, seals will start to come up any time after January if the temperature ranges up to the plus $10^{\circ}$ or plus $20^{\circ}$ mark. Bearded seals are especially prone to do this early in the year. By June and July, however, the ice in flat areas such as Peard Bay will look as though it is littered with seals basking on the warmer days when the ice becomes wet and later, quite rotten. It is said that individual seals may lie on the ice for up to 24 hours at a time, although they usually go down into the water at night to feed. At this time of year, they lose their blubber quickly and begin to sink more frequently when shot in open water.

Because they favor coming up on the ice where it is open and flat, seals are difficult to approach close enough to shoot. However, there are several methods which Eskimos use in order to get within easy shooting distance--formerly, in fact, to get close enough to harpoon them. The most commonly used techniques in this part of Alaska depend upon approaching the seal without having it see the hunter. This is difficult because ringed and bearded seals are very alert and although they sleep most of the time, this consists of short "naps" about 30 seconds to a minute long, sometimes several minutes at the most. Between sleeps the seal lifts its head quickly and looks around, wary of the danger of bears or Eskimo hunters. The basic method is, therefore, to move toward the seal when its head is down, stop when it is up.

Usually the seal hunter will wear a white parka cover and sneak up on the seal, carrying only his rifle. When he hunts he scans with binoculars from the highest places until he sees a seal. He then gets as close as possible by moving behind the cover of rough ice, maneuvering always downwind or across the wind from the animal, which would dive quickly should it smell the hunter. He also tries to approach from the rear if possible, although this is not at all essential. Ugruruk (bearded seals) usually will stay in whatever position they are in, but ringed seals will shift around frequently. If either one senses danger it will move nearer to its

hole or open crack, and when it is "spooked" it is difficult to approach. Once the stalk in open ice is begun, one must watch for head movements of the seal, stopping as soon as it begins to look up. Ringed seals raise their heads very quickly, while their huge cousin the bearded seal is rather more sluggish.

Each individual seal tends to sleep for a certain amount of time between alert periods, so the Eskimo watches his prey for a while and learns when to expect it to look up. The actual stalk does not have to begin before the hunter is about 200 yards away, but he walks forward only when the seal is asleep. Once he is close enough to stalk, which may be closer if rough ice allows him to approach to, say, 100 yards, he begins to crawl on his hands and knees. In so doing it is usually possible to find some small unconformities in the ice or snow which lie between the man and his prey, so that he can crawl forward unseen. Whenever he moves he is as quiet as possible, because seals hear quite well, especially when they are awake. The earlier it is in the spring the more difficult seals are to stalk, evidently because the late spring sun makes them sleep soundly. A breeze also helps because it covers the noise somewhat.

Usually the rifle is carried along with one hand, sliding it on the ice, or else is put in a rifle case and hung under the body parallel to the ice. Some men fasten their mittens or pieces of fur to their knees to prevent excessive noise. Around Bering Strait the Eskimos were observed using "leg protectors" of polar bear or dog skin, tied to the lower part of the leg, and a large polar bear skin mitten which reached to the elbow to act as a white shield. Because the ice may be wet, waterproof sealskin boots and pants are preferred today, and were the rule in the past. The hunter thus is able to sneak slowly and deliberately to within 20 or 30 yards, where he has an easy shot at the seal. When he does shoot he aims for the head if it is a ringed seal, the neck if it is a bearded seal. The shot must be a good one because even when mortally struck, seals can struggle back into the water, or sometimes just a spasmodic twitch will cause the lifeless body to slide on the smooth ice down into the water. In such cases it is lost even if it is buoyant, because it will not rise in the same place. For this reason it is best to rise fast and run to the seal as soon as the bullet hits. A neck shot that misses the bone will not stop the animal from escaping. One man told of lining up two seals and shooting both at once, although such a chance is rare because most openings are used only by a single seal.

It is remarkable that a technique has been devised whereby these wary animals can be approached to within shooting distance. The method is intimately bound to the peculiarities of seal behavior. But even more remarkable is the fact that men in former times could be skilled enough to creep to within a harpoon's throw, and sometimes even closer. Old man

Ikaḳ and Oġeaḳtaḳ had both gotten so close to seals that they killed them with a knife. Kusiḳ had twice grabbed seals with his bare hands. In cases like this it was often a young seal, because they are easier to approach.

The luckiest hunters are those who spot a seal sleeping on the ice close to a rough area. In areas where there is considerable piled ice this is fairly common. Once the seal is located the hunter stalks it by staying behind the rough ice, keeping downwind of it and moving quietly, until he is within shooting range. Seals tend to avoid places where they can be approached so closely, which is perhaps why smooth areas have such an abundance of sleeping seals in spring.

Another method of stalking seals, probably the most extensively documented, is that of "playing seal". This method is similar to the one previously described except the hunter wears dark-colored clothing so that he will look like his prey and not like a polar bear. In this case the seal is approached until perhaps 400 yards distance, and then the Eskimo begins to "play seal", imitating the movements of a seal when it is awake, crawling straight toward it while it sleeps. Thus he must always stay in plain sight and never deviate from a particular line of movement, because to do otherwise would frighten the prey.

As soon as the seal begins to watch the hunter he makes the movements of a seal, flapping his arms like flippers, and lifting his head periodically, never crawling forward until it sleeps again. The Alaskan will carry a knife or an aziguan, which consists of two or three bearded seal claws attached to a handle, and with this he will scratch the ice. The sound will cause the seal to watch closely for several minutes, but then it will "get tired" and will sleep. This is repeated as often as the seal watches, the hunter crawling forward while it sleeps. If the hunter does this and mimicks seal movements, the seal may eventually disdain from watching the man any longer, and will only look in the other direction, secure in the belief that only another seal is near. If the hunter has no knife or azigaun, he makes a rasping "Donald Duck" sound in the throat, or for an uguruk a high-pitched wailing noise will also serve the same purpose.

A method of stalking sleeping seals which is fully described for Greenland and the Canadian Arctic is the white shooting screen, which was known and occasionally used in Alaska. Shooting screens are simply a white cloth "sail" held on a wood frame. They vary in size from only a foot or two high and two feet wide to several feet wide and up to four or five feet high. A common type described in the literature is small and is fitted onto a very little sled, behind which the hunter hides, with his rifle pointed through a small hole in the screen. This type was described by informants from Kotzebue, Point Hope and Wainwright, and was said to have been used

only by "old-timers". Another type described was triangular and carried in the hand.

Shooting screens are very effective and require less skill to use than any other method of hunting sleeping seals. The hunter either crawls or walks behind the white screen, stopping every time the seal looks up. He is careful to step quietly and not to get upwind, and keeps the sun more or less in front of him so the screen looks like a piece of ice and does not have his shadow on it. If possible, some rough ice or snow-covered land should be kept behind the hunter for a backdrop. Making a low humming sound has been suggested for a cover-up if the ice crunches loudly underfoot (25), and it is not impossible that scratching on the ice would also be a help toward approaching the seal more easily. Again, after the seal is shot, the Eskimo runs to it to be sure that it is not just wounded and will not slip back into the water. Wounded seals are killed by bending their heads down onto their chest until the neck breaks, by slugging with the fist, or by clubbing with a wooden-handled club with a stone head.

An unusual method of hunting seals was said by Ikak to have been used near the Mackenzie River. When the river flows out over the sea ice in the spring and the ice becomes a dirty brown, the men walk out over the ice in search of ringed seals. When one is sighted they walk up toward it in plain sight, and eventually the seal flops into the water. But the hunter then goes to the hole and waits by it with an iron hook or harpoon. Soon the water begins to jiggle and the hunter prepares for the seal to emerge. When it does he harpoons it, or simply hooks it with a quick thrust and hauls it up on the ice where he kills it by hand. A similar technique is described for the Bering Strait region, where hunters cover the hole with an "arch of snow," so that the seal will not see the hunter and will stick its head up right next to him (2). Sometimes, in areas of Canada, a seal will fall asleep on the ice and the hunter can walk right up to it and kill it (16).

Sleeping seal hunting is a method which can be used during a large part of the year, is adaptable to several distinct techniques of execution, requires little special equipment, can be carried out by a novice, and may be used without the need for open water. Because of these advantages this is today an important way of obtaining seals among the Alaskan Eskimos. It is learned and mastered by boys, and is used by men even after they are too old for most other kinds of hunting. The method is said to be very productive, so that a man can drive his team out over the ice, stalk and kill a seal and put it in a deep cool puddle to keep it fresh, and drive on to find another seal, all in the space of an hour. In this way five, six, or even more seals, including the 1,000 pound bearded seal, may be killed in a day.

# XVIII

# OPEN LEAD SEALING

## Open Lead Hunting: A Modern Method

Besides sleeping seal hunting and shooting seals from a boat during the summer, this is the other method of sealing used in modern times. It is important for several reasons. It occupies a very long season, from November until June or July at Wainwright, during which it is a major activity. It is productive, and especially so at Point Hope, where a single man may kill 200 ringed seals and a few bearded seals during a productive winter. And it has caused very important modifications in terms of the technology as well as influencing the entire settlement pattern of this coast.

One of the changes in the use of technology in recent years is the evolution of extensive dog team travel In the past the seal hunter who set out on the ice usually walked. There were several reasons for this: First, he could not usually expect to get more than two seals in a day's hunting, and more frequently got one if he got any at all. Second, hunting was done for the most part either at seal holes or for sleeping seals, with nets during the night, and for polar bears. For sealing activities, dogs were better left at home; and for bear hunting it would be difficult to say whether dogs were used to chase bears down and detain them, or left home because they too often frightened bears away. Third, dogs were considered very valuable, and using them on the ice was taking a chance of losing them, so the hunter pulled his retrieving boat out onto the ice with a hand sled (during early years following introduction of the rifle, perhaps earlier). And fourth, dog teams were small and the use of lead dogs was unknown in old times, so efficiency of travel was much less than today.

In modern times the size of dog teams has increased due to greater food availability, so that travel is very rapid, an important factor in open lead hunting because the first man to the places where there are seals takes the largest catch. Also, with open lead hunting the daily kill for an individual can be large, over 1,000 pounds in an excellent day, and such a great amount of meat cannot be pulled in on foot. And with the introduction of firearms and the consequent increase in importance of this hunting method, there has been a considerable increase in the use of boats for retrieval, and boats are far more efficiently transported on a dog sled. These factors are combined with a cultural trend which cannot be put in such concrete terms. The younger generation of hunters, 40 years old or less, do not walk as the older men did, much the same as has happened in the lower "forty-eight".

Dogs are, therefore, one of the most important "tools" which are used for this method of hunting. In describing open lead hunting, we will review the seven different activities involved during a day's hunt, from beginning to end.

These seven activities include: (1) preparing for the hunt; (2) transporting to the lead edge; (3) locating game; (4) attracting game; (5) shooting; (6) retrieving; and (7) transporting game to the village. In addition we will consider, perhaps too briefly, the utilization of seals and the effect of technological changes on seal hunting.

## Use of Dog Teams

We have already introduced the first topic and the second by discussing some aspects of dog use for seal hunting at open leads. Dog teams along the northwest Alaskan coast vary in size from 3 to 16 dogs, with a "good-sized" team considered to be 9 to 11. This differs sharply from the condition 60 years ago and earlier, when, as a rough guess, the average was closer to four or five. The increase has come about due to a more affluent economy in recent years, by which less of the game (and perhaps as much game is taken per individual now as in the past) is used by humans, and more can be diverted to use for dog food. Men therefore accumulate larger numbers of dogs for prestige, increased mobility, and in recent years for racing. Whereas an optimum number of dogs, for high mobility per amount of food consumed, might be set at seven, many individuals own and use twice that number.

Thus the individual hunter who is able to outdistance his fellows in what is now competitive seal hunting, is able to take more seals, transport the load home quickly, and regain safe ice more rapidly if danger should arise. He also ranges farther in land and sea ice hunting, increasing his productivity, and is able to use some hunting methods, such as chasing caribou herds, to greatest advantage. Dog teams which can cover 30 miles in 2 hours and 20 minutes, as was done in a dog race at Wainwright, or travel the 100 miles to Barrow in 24 hours, are much more efficient than the old-time teams which plodded along behind a woman who led them.

Changes have also occurred in the types of sleds being used and the methods of construction. At Point Hope the light "basket sled" is used on the ice, a type which can be pulled very rapidly by a team and does not add much weight to already heavy loads. The more bulky flat sled, or "scow" sled, is used at Wainwright and Barrow. This type consists of two heavy wood runners made from 2 x 8 lumber, from 8 to 12 feet long, with a bed of 1 x 4 planks 22 to 36 inches wide. These sleds are sturdier on the rough

sea ice, but heavier. Both types use iron-shod runners, which permit them to slide fairly easily over the sticky salt ice. Hardwood runners are used for travel inland during the cold months, but steel is used on land in spring and fall. In the rear of the flat sled, or kamotigilurak, there are two upright stanchions which the driver usually stands behind. This type of sled was introduced in fairly recent times, evidently by Rasmussen and his Greenlander companions.

Sleds used in Barrow during the latter 19th century were much shorter on the average, running up to eight or nine feet long (6) and, one gathers, were rarely taken onto the ice. These sleds had runners of ice-coated mud, whale bone, or ivory. The latter was considered best for sea ice use (14). The entire area of dog technology deserves a thorough study, both as to historical changes and the economic and cultural influences of recent changes.

## Preparations for Daily Hunt

Almost every time the modern Eskimo goes out to the lead, he uses his dog team. He takes note of the weather and ice conditions the night before, and seeing that there is a good possibility for open water the next morning and that the condition of the weather will probably be favorable, he plans to arise before dawn the next morning. This means, in December, that he can sleep until 9:00 AM, and in late March or early April that he must arise at 3:00 or 4:00 AM. On awakening, he listens for the wind. If it is rattling his chimney and buffeting the wall, he probably won't even get out of bed, but otherwise he checks the smoke from the chimneys and the other indicators of wind speed and direction to see if the ice will be favorable. And he looks to see if there is an open lead, easily visible even before dawn if there is a steam fog or water sky. The temperature is immaterial, even if it is as low as minus 40°, except that he might use it to help predict the weather. Only if it is minus 45° or colder, or if there is a chilling wind with below minus 30° temperatures, will he be deterred.

Once he is awake, the primary concern of the hunter is to reach the lead edge before the rest of the men, so if he eats he does so hurriedly. He, or his wife, makes tea, and some of it may be poured into a thermos bottle that he carries. When he goes outside, it is probably dark. He pushes his dog sled into position beside the long line along which his dogs are spaced on individual chains. If he owns a small retrieving boat he places a caribou skin on the sled and then lashes the boat on top. To do this there are rope loops along the sides of the sled, and rope is strung back and forth across the top through these loops. The ropes are pulled

very tightly. Inside the umiahalurak or kayak, whichever he owns, he places his rifles, manak, and other equipment.

Men who do not own boats carry only a caribou skin on the sled, on top of which they lash one or two rifles and the unaak. Other gear is placed in the cloth sled bag which hangs from the upstanders. This includes, for any seal hunter, ammunition, a large knife, a seal-pulling harness or uñutak, and some extra gloves. If he chooses to drag the line of his manak on the snow he unwinds it as he goes, dropping the float in his sled bag. He may also put a pair of binoculars or a telescope in the sled bag. Men who do not carry a boat seldom carry a stove, taking a thermos bottle of tea or just a cup to drink tea brewed by another hunter. Everyone usually carries some food, pilot bread, pancakes, or a can of sardines. Those who carry a boat take along a stove and, usually, a "grub box" with bread, pilot bread, seal oil, etc., in it. These men are also likely to carry extra equipment which probably will not be needed--extra clothing, an axe, an extra rifle, and so on--because these things are easily put into the boat.

Once he has loaded his sled, which he does in only 5 or 10 minutes, he brings the dog harnesses and lines from the hallway or inside of his house. The hemp line is attached to the sled with a shackle, and a two-pronged (one prong in the case of Point Hope) snow hook is attached by its line and plunged firmly into the hard snow. While he lays out the line and separates the harnesses so that they are not tangled, his dogs begin to bark and howl with excitement. The Eskimo silences them as much as possible, lest their noise give haste to other hunters making the same preparation.

The exception to this rule of competitiveness is the hunting partnership, in which two men habitually go out hunting together. This may be a stable partnership, such that the men almost always hunt together, or it may be a day-to-day arrangement, the pairing varying for the individual each time he goes out, but including a small number of usual partners. Certain individuals almost always go with one or two partners whenever they hunt, while others usually go out alone but join up with someone else when they reach the ice. The men who decide the day before that they will go hunting together usually leave the village together, one having gone to wake the other or to tell him that he is preparing to leave. Occasionally two men will go on one sled, sharing equipment and dogs, but this is not favored because there is too much need to hunt close together with such an arrangement, and the dogs run slowly with the load.

Once the Eskimo has put his dogs into harness he waits for nobody. His team runs eagerly for the trail and out onto the ice as soon as they feel the sled jump forward as he lifts the snow hook. This is where the man with fast dogs has the greatest advantage because he will probably not be beaten

to the lead. It always happens that at least a few men leave at almost the same time, and since the behavior of seals is such that they are most abundant in the dawn hours, and diminish quickly once the shooting starts, the "early bird", indeed, gets the "worm".

## Locating Seals at Open Leads

The Eskimo can make general predictions as to the probable abundance or scarcity of seals in the open lead even before he leaves the village or before he reaches the lead. Certain general factors of the weather, ice or month of the year influence the availability of seals along the margins of open leads, although none of these is so definite that deviations could be called uncommon. The seasonal movements of seals were mentioned earlier. Hunters put their maximum effort into sealing during December through March, because they know that by late March the seals begin to move under the ice away from the lead (or perhaps to flat ice areas in bays) to sleep on top of the ice. From this time until June they will see few seals in open water. In the whaling camps at Point Hope during May 1965 there were seldom more than one or two seals seen during a 24 hour period.

The occurrence of seals near the edge of the landfast ice is also influenced by the wind. When there is a strong wind blowing and a lead is opened, the ringed and bearded seals seek out smooth water along the windward edge of the ice. This means that they crowd in along the landfast ice during any wind that opens or widens a lead. Hunters do not normally travel out on the ice when the wind exceeds 20 or 25 mph, because of the ice danger and the fact that seals are difficult to shoot and retrieve in water that is not fairly smooth. But the seal hunters awaken early every morning when they expect that the wind may have subsided, because immediately after storms the seals are still abundant along the edge.

On the other hand they say that there are few seals along a lead which has just opened a few hours or perhaps up to 12 hours earlier. If the lead is wide and has remained for several days or more it is also good for sealing, although subject to great variation in their abundance due to factors such as wind and current, as well as many other idiosyncrasies of these animals. Some of these peculiarities of the abundance or absence of seals, in general areas or around particular ice formations, are understood by the Eskimo, and we will discuss these further. Others are a mystery even to these people who continually observe them and must know how they behave in order to hunt them.

When a man reaches the lead before dawn he stands peering into the deep blackness of the water, hoping to glimpse the shadowy motion of seals swimming near by. More often he will hear the loud splash of a seal which has risen nearby and after watching curiously for a moment has become alarmed and submerged with a quick sidelong dive. The hunter knows that seals usually do this when they are not moving in any particular direction, and that these violent dives usually are followed briefly by the reappearance of the curious animal. If there is daylight he will wait until the seal rises high in the water to see him and then will shoot. But if it is dark he will wait quietly, perhaps joined by other hunters, for the earliest gray light. Those who have telescopic sights on their rifles are more fortunate, because with a scope it is possible to see the target in the dark, and therefore to begin shooting earlier. Sometimes a man will overestimate his ability at this and will aggravate other hunters by beginning to shoot before it is light enough for him to hit the small dark target, frightening the seals away.

If he arrives at the lead after some of the others, the Eskimo is likely to find that they have been shooting and have frightened away the seals in the spots closest to the village, and he will have to try to catch up with them. He first notes the current direction and then will probably move along the lead up-current, knowing that seals usually move with the current and in order to be successful he should try to catch or pass the other hunters. This is a general tendency of seals, to be found up-current, but not by any means a rule, because they are likely to appear even just down-current from a group of hunters. If there are few seals to be seen, hunters will most likely move along the lead against the current in search of areas where seals have congregated. If the current does not parallel the lead or is flowing very slowly, the men will go in either direction depending upon their whim or upon their knowledge of the bays and points of ice along the edge.

Sealing is said to be best when there is a strong current, evidently because the animals keep moving along with it and by sitting in one place the hunter can wait for them to come by. At other times he must move around to find groups of seals or scattered individuals which are not moving in any particular direction. Ringed seals occur in far greater numbers than the occasional individual bearded seal, at least during winter sealing. These smaller seals do not occur evenly along an open lead, but rather tend to congregate, so that when several are seen there are likely to be more in the immediate vicinity. These groups are localized, however, so that in one spot the hunters may see many seals, while a few hundred yards away there are none at all. This is true for all seals except the young males, which tend to be "loners".

Seals are said to congregate where there is an abundance of food, which perhaps indicates that their prey is found in local concentrations. In some places seals will be found every day as long as the lead edge remains in the same place. At Wainwright the lead remained open near a very high ice pile for about two weeks. Every day, even if there were no seals seen anywhere else along the lead, there were seals near this ice pile. This was said to indicate that fish were always abundant around this ice, where they could stay in the lee of the current, and they were being preyed upon by the seals.

There are other ice formations which are considered good places for seal hunting. There is little waiting for seals along straight featureless ice edges. Rather, the men follow along the ice apron with their dog teams until they find some sort of a point (nuwuk) or bay (kanerlluk), because in such places seals are more often spotted as they rise close to the edge of the ice. This is partly due to the fact that, especially with a strong current, seals rise to breathe on the up-current side of a point, then swim under it and bob up near the edge of the opposite side. In the case of bays, and other irregularities of the ice edge, seals, for some reason, prefer to stay in such places.

Seals also move out around the edges of points to pass them by, so that hunters will station themselves at the ends and await their game. Or if a point juts out from the opposite side of a lead the hunters will wait just across from it, because seals are guided by it closer to the landfast side of the water. If there are two points across from one another but one is down-current so that they overlap in their projection, this is an ideal spot. Seals rising along the far side, if the lead is narrow, will tend to rise between these points. And if the down-current point is the landfast ice, the hunter can shoot seals so that they will drift right to him. This seldom happens along a straight edge, because if the current is inshore the lead will close over with ice before much hunting can be done. Basically, then, the Eskimos hunt near irregularities in the ice edge, the more sharply irregular the better.

It has been noted that the hunters will stop in one place to hunt for a while and then move along the lead, travelling with dogs on the ice apron. How do the hunters decide when it is time to move and how far to move, and under what conditions do they remain stationary? In the first place, there is no "black or white" basis for the decision. It usually is decided to move when the seals have been frightened away from one area and are not moving enough to keep appearing at one stop. In this case they must be found. As the Eskimos ride their sleds they watch the water very carefully until they see a seal, and there they usually stop to try for it. Or they may see a promising point or bay ahead and move to it. If there are few

seals the men move often, and if seals are abundant, especially if they are swimming with the current, it is best to remain stationary. It is especially preferable to stay in one place for long periods, an hour or more, if there are many hunters.

During the day an Eskimo will travel from 3 to 10 miles or more along the lead. By mid-afternoon he begins to travel back along the edge toward the village, stopping to hunt as he goes. In the evening hunters tend to congregate to talk and wait. They say that seals come in toward the lead around dusk, when the winter sun silhouettes them and makes very easy shooting. At times there are groups of 5 to 15 men standing around watching half-heartedly for the occasional seal, finally breaking up to go home.

## Attracting Seals at Open Leads

Seal hunting would be far less productive if there were not methods of attracting these curious animals. Ringed seals, and probably also bearded seals, are irresistibly drawn toward almost any sort of sound, especially mechanical sounds such as scratching and pounding. The best method of attracting seals if none are seen, or drawing those that are sighted to within range, is by scratching the ice. The traditional instrument is the aziqaun, which, as described above, consists of a wooden handle with several bearded seal claws attached to it. This makes the loudest scratching sound, but at Wainwright has largely been given up in favor of the hunting knife, or savik. In addition the ice pick on the unaak and the butt of a rifle will also work, sometimes very well. The method is simply to rhythmically and fairly slowly scratch the ice near the edge, sometimes pausing for a moment, until the seal has been drawn as close to the edge as possible.

Other methods include chopping the ice with the unaak, making a throaty "Donald Duck" sound in the throat, beating the side of a sled or skin boat with a stick, operating a camp stove, whistling, humming, driving a dog sled along the ice apron, and probably even just talking. But as much as seals are attracted by noises, they are frightened by movement. For this reason, the native hunter sits on the ice or on his sled, scratching the ice, and does not have to move at all to shoot. If he happens to be standing he moves quickly, crouched over, grabs his rifle, and sits or lies prone to shoot. One of the greatest assets that the Eskimo has in his hunting is alertness. Whether he is brewing tea, driving his dog team, or talking to another man, his eyes are always flashing over the water. When the seal rises he has his gun in an instant and fires.

One further method of "attracting" seals, which is not often used, is that of chasing seals to the open water by frightening them away from breathing holes back from the water's edge. In the spring, especially, seals will appear in the water only once in a few hours, so a hunter who has seen few seals may take a walk through the ice away from the edge, and then hurry back to his station to wait for a seal to appear in case there were any in the area over which he walked. Because the ice is so rough in most places, this is rarely done.

Almost all of the hunters agree that for open lead sealing it is best not to wear a white parka cover (kategenisii) because it makes the seals afraid, thinking they have seen a polar bear. However, this is one of the more obvious cases when the actual practice differs from the ideal, because during the winter (at Wainwright) at least 75% of the 39 men who were seen hunting seals wore white parka covers, and about 50% do so during the spring. In fact, men were heard saying that white should never be worn for this activity, while they themselves were sealing and were wearing white. It is strongly felt, and actually practiced, that red should never be worn for any hunting. "It will scare some animals like seals away and make other animals, like bears, more dangerous."

One of the older hunters said that young men of today are not as good at seal hunting as their elders for two reasons: (1) they do not shoot as accurately, and (2) they do not wait for the best and closest shot. When a man nowadays is hunting with others, he does not wait until the best shot because if he waits too long another man will shoot first. There is a loose territoriality, so that one man seldom will shoot a seal if it rises in front of another, but if the seal rises equidistant between them, or far enough from the edge to be anybody's game, anarchy prevails. There is never any "gentlemen's agreement" to wait and try to bring the seal in and allow the closest man to have a clear, careful shot. There is no question that this lack of organization results in less overall productivity.

When a man is alone, on the other hand, he waits patiently until the seal is attracted as close as it will come, and until it rises high in the water for the best possible target. When this is done there are few misses. A man will wait too long on occasion, thinking that he can bring the seal just a bit closer, and then have it tire of the game and disappear. One Eskimo told of waiting until two seals had lined themselves up perfectly and then shooting both of them at once.

## Shooting Seals

On the flat ice apron the native sits on the ice to shoot, supporting his arms on his legs, or occasionally sits or rests the rifle on his sled. In rough ice he lies prone, with the gun supported on a piece of ice. Shots are never taken from a standing position. In former times, especially because there were no telescopic sights, hunters used notched sticks or bone pieces to support the rifle. In 1965 the Wainwright Eskimos owned 84 high-powered rifles, for an average of 2 per household, and 50 .22 caliber rifles, averaging 1.7 per household; 30 out of 44 households owned at least 1 rifle with a telescopic sight; and there were 57 shotguns, with only 4 households owning none, and 12 pistols (15).

Most of the high-powered rifles, which are the types used for seal hunting, are .220, .222, .243, .264, .270, .308, and 30.06 caliber. Most preferred for seal hunting are .220, .222, and 30.06. The lighter calibers with high velocity, are perhaps the most accurate, and make a smaller hole in the skin. There are often days when almost every man is shooting inaccurately, and the weapons must be re-sighted. This is supposed to be caused by changes in the temperature altering the velocity of the bullets. Some men suggested that carrying the shells inside a mitten or in a pocket would maintain accuracy, but this practice was never observed. Rifles must also have all lubricants removed from them so that they will not freeze. The head of ringed and bearded seals is a small target, and misses are very frequent. One of the most commonly asked questions besides "How many seals did you get?" is "How many shots did you take?" Some men were observed to shoot 15 times without a hit, but perhaps one hit in three or four shots is closer to the average. Only occasionally does the seal expose more than just its head.

## Retrieving Seals in Open Water

During the winter, nearly all seals will float after they are killed, but a small percentage (est. 5 to 10%) will sink and be lost. Rarely, a seal will sink below the surface for several feet but then will go no deeper. With the sinking retrieval hook (niksik) they are fairly easily snagged. During the late spring and summer, when most seals sink, this is common, so the niksik is always carried.

There are four ways to retrieve a floating seal: (1) retrieval hook, (2) boat, (3) on foot, (4) retrieving harpoon. In the last case, this method is known from the literature but is not used for winter sealing today. It is now probably used only for summer walrus hunting. The retrieving harpoon consists of a shaft, foreshaft, toggle head, line, finger rest, and ice

pick. The ivory pick is used for testing young ice and as a walking aid in rough ice. The harpoon is tossed into a dead seal, and it is drawn in by the line. During the late 19th century this type of retrieving was very commonly used (16), but now the harpoon has evolved into the more simple ice testing pole with a retrieving hook on one end, which retains the same name (unaak) as its predecessor. Retrieval hooks (manak, niksik) are more efficient than harpoons because they can be tossed a greater distance with accuracy.

There are some instances where seals can be retrieved without any tool at all, or at most with the hook on the unaak. This applies when the seal is carried to the ice by the current, either flowing toward the ice edge, or parallel to it and at right angles to a point. If the current is only slightly onshore the hunter may try for the closest possible shot by waiting 30 yards back from the edge and attracting the seals as close to the ice as he can. In this way the seal will drift in to the ice. Sometimes a seal will be killed but cannot be retrieved because it is out of range of the manak. If it is in a closed bay or hole, which it cannot drift out of, the hunter will return the following day hoping to find it frozen into ice solid enough for him to walk to it and chop it out.

The method of retrieving with the manak and niksik has been discussed above. With these hooks the man is always limited by his ability to throw accurately and to throw out a good distance. Although some men can fling the manak 50 yards or more, they usually do not shoot a seal farther out than 20 or 30 yards. This is mostly done because of the current, which can carry a seal away from the edge very rapidly, and because the man with only a manak available is probably sufficiently alone that he can wait until the seal comes within this range. Men will sit and watch a seal for a half-hour without shooting if it is too far out or if the hunter feels that he has walked too far from his sled from the manak in it. Usually this occurs only if he is waiting for somebody to finish retrieving a seal with a boat.

Once a dead seal has been hooked with a manak it is pulled in very gently, or may be allowed to float in by the force of a current paralleling the lead. One must be careful not to allow it to be pulled beneath the ice and come unhooked. It may be possible to pull the seal up on the ice apron, or it may be necessary to hook it with the unaak. When this is done the seal should be hooked only in the head, because if hooked in the body it can slip off too easily. Usually hooking is done through the nose, upper lip, or lower jaw. If there is a large bullet hole this may be used.

At Point Hope the retrieving hook is carried, with the line coiled up, fastened to the bottom of a small sealing stool such as is used for breathing hole hunting. This may be done in order to keep the line straight,

The unaak, or ice tester, may be placed on thin ice to prevent breaking through while the manak is tossed to retrieve a seal. The dark streaks indicate places where seals have been pulled up onto the ice.

A sealing stool in use at Point Hope. The niksik, or sinking retrieval hook, is attached to the lower corner, and the line hangs beneath the seat.

because the stools are used to sit on along the ice apron, or perhaps in case the man drifts away and must hunt at breathing holes to survive. These stools were never seen at Wainwright.

Finally, there is retrieval by boat. In northwest Alaska this rifle hunting method has given the impetus for the development of small skin boats which are used almost solely for retrieving seals killed from the ice edge. There are two types, the kayak and the umiahalurak, the former being older and now almost extinct, and the latter more recent and now very popular. Some details of the history of these boats are given later.

Not every hunter owns a boat, so there are usually one to five or even more hunters following near to the man who is carrying one on his sled. Each man is allowed to borrow it in order to retrieve a seal that he has shot, provided that he does most of the work involved himself. In former years the owner of the boat was given a small share of each seal retrieved with it, but this is no longer considered necessary. Some men who own boats complain that the other men are too lazy to build one for themselves and always follow them around. This feeling is caused mostly because these men do not allow the owner of a boat to hunt alone, in which case he would get more seals. At Point Hope there were apparently more small boats per man but this was only an impression due to the number of them seen in the village.

If a seal is shot, then, the one who killed it unties the boat from the sled very quickly, and pulls the boat to the edge of the safe ice. Usually another man helps him carry it, so that it does not have to be dragged. The umiahalurak is only 7 to 9 feet long, and 36 to 40 inches wide, so it is not very heavy. The kayak is 9 to 12 feet long and 24 to 30 inches wide, but is much lighter in weight. Rough guesses of the weights would be 50 to 60 pounds for the open skin boat, 35 to 40 for the kayak.

The open boat is pushed onto the weak ice by the user, who stands at the back with his legs spread wide to prevent breakage of the ice. When the boat breaks through the thin ice he enters it from the rear and sits down facing the stern. With the two short oars, fastened with lashings to the gunwales, he breaks the ice and forces the boat into open water, or he may use a stick or a niksigaurak (dragging hook) to pull or push the boat through the remaining ice. In the case of the kayak, the cockpit is straddled as it is pushed out, and when the ice begins to break or flood, the boat is entered. The eight-foot-long double-bladed paddle is used to force it the rest of the way through the ice to the water.

Dead seals float very low in the water and are not easily spotted, especially from the open skin boat in which the man does not face the

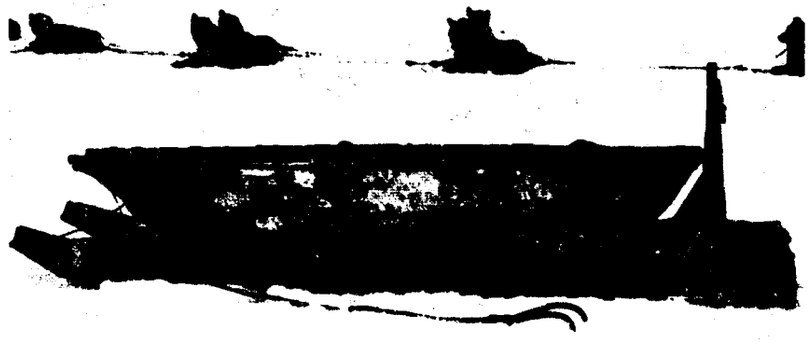
direction he is going. Whenever it is very cold there are certain dangers involved with paddling out into the lead. If the seal is hard to locate and especially if it has drifted 80 or 100 yards out, the paddle or oars will be encrusted with a bulky coating of ice. This ice becomes very heavy and makes the blade less efficient. Secondly at the same time one's hands become colder and colder from gripping the handles tightly, making it easy to freeze them. For this reason heavy mittens may be taken in the boat. Third, the current makes it difficult to progress, especially while towing a seal or seals back to the edge. And finally, it is easy to be trapped in young ice and find it very hard to release oneself from it. The drag hooks can be used in emergency to pull the boat through the ice, or the unaaḳ may be carried for the same purpose. It is possible that a combination of these difficulties could carry a man away with the current and wind.

Once the seal is reached it is hooked in the head with a niksigaurak. This is a metal rod attached to a wooden handle, with six feet of heavy cord strung onto it. The rod is bent to form a hook, sharpened, and barbed, so that it can be stuck through the seal's hide with a sharp stab, and will not come out. Once the seal is hooked in this way the Eskimo holds the cord in his teeth, dragging the seal in the water, as he paddles back to the ice. Two hooks usually are carried so that one can be used for each of two seals. If more are shot at one time the line is threaded through the skin of each. When a man finds that there are many seals in one place, if the current is sluggish, he will shoot up to five before going to retrieve them.

Another method is to mark the seal by throwing chunks of ice into the water at intervals of several minutes and following them to locate it. One man who could not use a ḳayaḳ used to do this when hunting with his father. The father would retrieve with a ḳayaḳ while the son shot. The son would throw out pieces of ice, remembering how many he had tossed, and tell his father that after the sixth or perhaps seventh piece he should find the seal. This is necessary because of the steam fog along the lead.

Seals are dragged with the cord held in the teeth, never tied on the boat, because of the danger of a walrus coming up to pull the seal away, as mentioned earlier. Once the hunter has paddled back to the ice edge, he is pulled up into the same spot where he broke the ice to go out, the pulling being done by a partner using the hook of his unaaḳ. If there is no partner he ties a line to his sled hook and sets the hook into the ice, so he can pull himself up. This is almost never necessary. The boat is pulled up onto the safe ice far enough that he can get out, and then the seal is also pulled onto the ice by the partner, who hooks it with the unaaḳ or pulls it with the dragging hook line.

Two of the principal informants at Wainwright engaged in covering an umiahalurak with a new bearded seal skin.



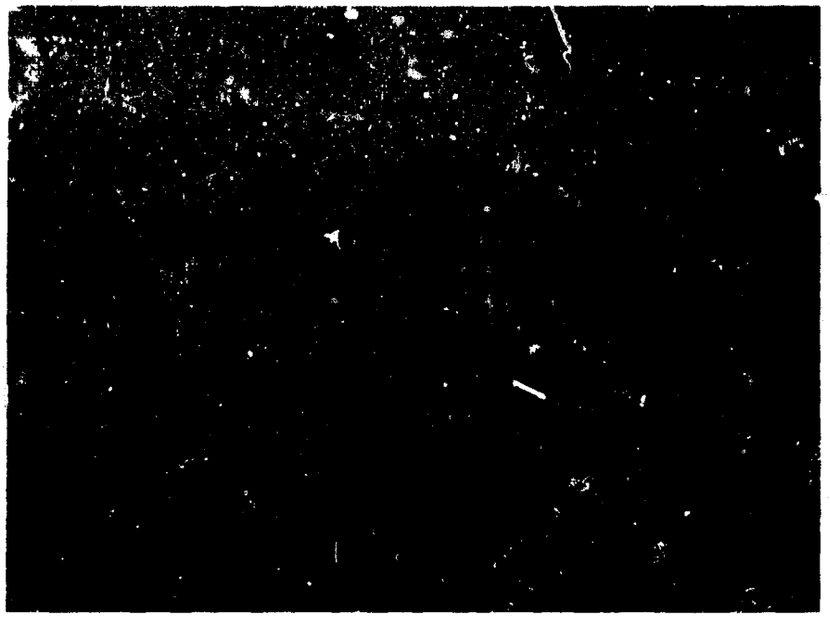
The umiahalurak, open retrieval boat, lashed to a sled in order to carry it to the open lead.

The man at the right spreads his legs wide in order to prevent breaking through thin ice near the edge of the ice apron. The hook of the unaak will be used to draw the boat up onto the ice.

Rowing out to retrieve a seal with an umiahalurak, or open skin boat. Steam fog obscures visibility to about 50 yards over the water.

Preparing to launch the umiahalurak. A spread-legged stance, with the arms supported on the stern, is used to push the boat as near to the edge of the ice apron as possible without breaking through.

The oars are used to pull the umiahalurak through young ice and into the open water in order to retrieve a seal.



After the seal (right) has been retrieved, the kayak is drawn up onto the ice apron. "Lines of equal ice development" are clearly defined in the illustration by parallel rows of frost crystals on the young ice. Note the flooding of the ice due to bending.

Pulling a killed seal back to the ice apron with a kayak. The safe ice is sharply distinguished from thin black ice near the edge.

Back on the ice the boat is turned over and the ice which formed on the paddle blades and the skin cover itself is beaten and scraped off. For this the large knife (savirakṭuun) is used, and the bottom is beaten with wooden sticks carried for the purpose. Not infrequently seals are attracted by this noise.

An advantage of boat retrieval is that fewer wounded or stunned animals are lost, because they can be approached and shot by boat. Wounded seals cannot stay down long, and with some persistence usually are killed. An Eskimo was once observed chasing after a wounded bearded seal for over an hour, but in this case without success.

## Transporting Killed Seals

After seals are hauled up on the ice they usually are left near where they were caught, lying on their back so that they will freeze flat and load easily onto the sled. If the hunter is not carrying a boat he ties the seals in the middle of the sled facing forward, when he passes by on the way home. With a boat it is not so easy because they must be l shed alongside. If there are only one or two they are placed on their side right along the stern of the boat. Additional seals are lashed along the bow; and if there are more than four, the boat is laid on top of them. If a hunter takes seven or eight seals they are a very bulky and heavy load for any sled, piled in two or three levels, with no room for a boat.

Hunters favor large sleds, 11 to 13 feet long and about 30 inches wide, for sea ice use. This makes it easier to ride through rough places and to carry the heavy loads without too much danger of breakage. The stanchions take a severe beating, and are broken several times each season. At Point Hope, where basket sleds made of hardwood are used, sleds are frequently broken and probably have a rather short life expectancy.

The Eskimo who goes sealing on foot is faced with the problem of getting his game home. If there are no dog teams around he will not shoot more than one or two seals. If he kills and retrieves one, and decides to try for another, the first is buried in a snowbank to prevent it from freezing hard. Then when it is pulled, the head turns up "like the bow of a sled" and rides over the irregularities.

The seal-pulling harness, or uñatak, consists of a rope or bearded seal hide thong which forms a loop large enough to be used as a strap around a man's chest. Onto the strap is attached a line about four or five feet long, with a small double loop at the end. One end of the loop is tied to the harness line and the other is put through a slit cut inside of the lower

mandible and is placed around the snout. This way it is easy to fasten onto a seal without tying any knots, and equally simple to remove the line.

Nowadays men pull their seal themselves, sliding it laboriously through even the roughest ice. But their wiser predecessors had two kinds of draught animals to pull the game home for them. The first was a dog, which could even be sent home ahead of them with the seal; and the second was their wife, who was instructed as to the whereabouts of the ringed seal or even a large bearded seal, and gamely went out and pulled it home. This was not considered unjust, since the man might wait a full 24 hours at a breathing hole for the seal.

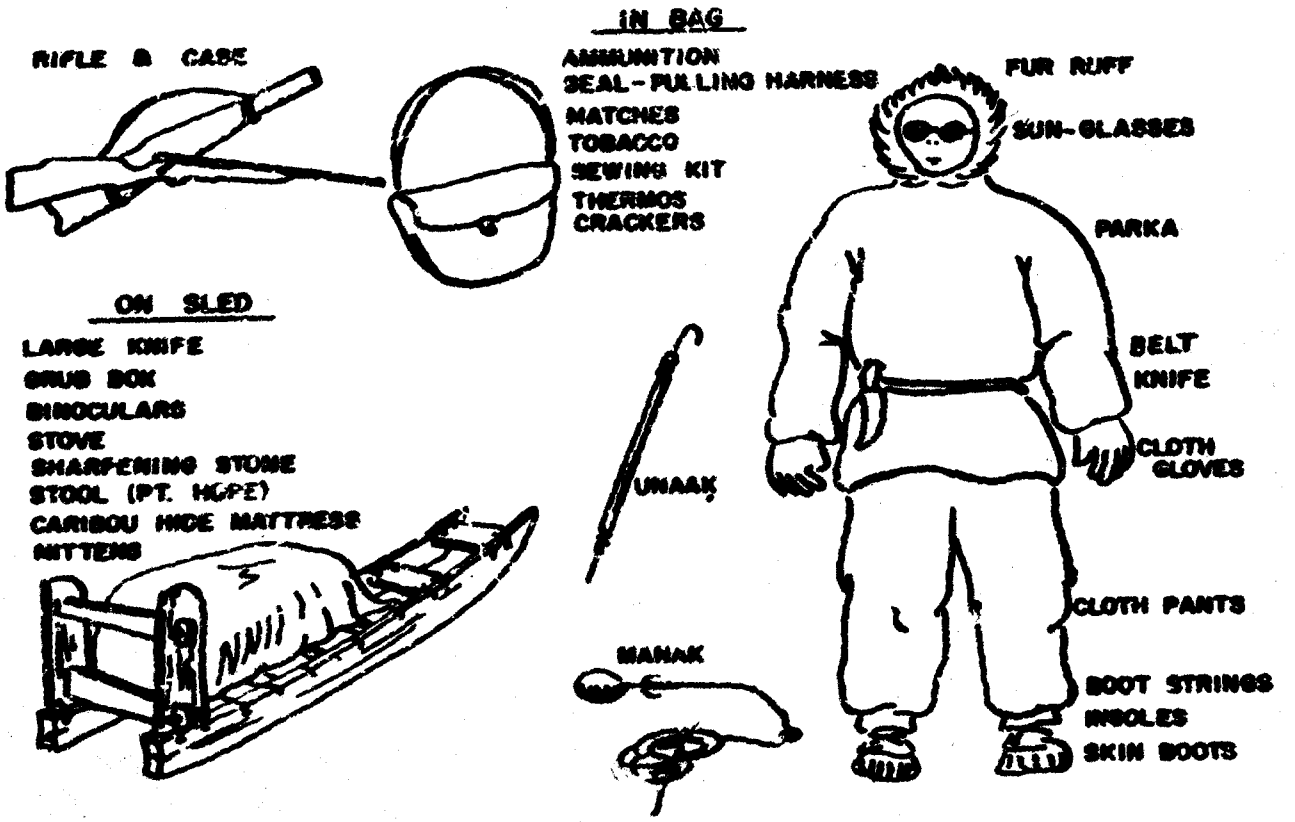
One man at Wainwright was observed to lighten his seal by cutting it open and removing the blubber from the ventral half of the body, leaving it on the ice, and sewing the skin back together with cord. An old-timer told of shooting two heavy uguruk (bearded seal), when the ice was rotten in the spring. He was on foot, but could not leave them there until the next day because of the condition of the ice. So he cut one up, removing the skin and taking the meat from the bones. And the second he partially butchered, leaving the skin, backbone, head, and some other bones, removing the ribs. Then he put the remains of one inside of the other, sewed it together, and began dragging. The load was still very heavy, and he pulled "all day and half of the night" to get to shore. This he said was one of his most tiring experiences. But now, over 60 years old, he still walks out onto the ice, pulls his own load, and scorns the laziness of youths, who insist on riding everywhere.

## Uses of Seals

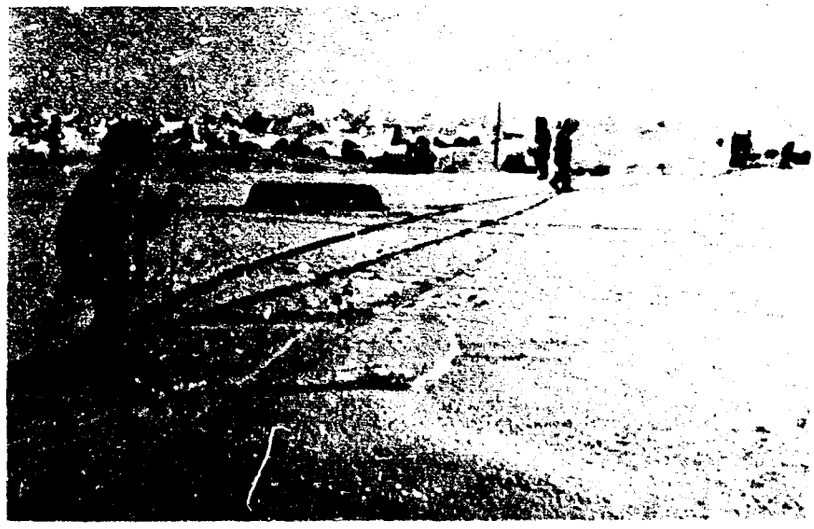
Open lead hunting can provide a man with 1,000 pounds of game in a day, even more on occasion. A single bearded seal may weigh that much alone, for example. One man at Wainwright had taken 35 seals in a single day, and his 30-year-old son had once taken 30. Almost every man has taken 10 or 15 seals in a day. However, under normal conditions the hunter brings in one to three seals each time he goes out, if he is proficient. In earlier times at Wainwright there were winters when a single hunter got over 80 seals by this method, and over 1,000 were taken by the combined efforts of the hunters. But today only 200 or 300 are killed in years when caribou are abundant, more when there is not enough of this preferred meat or when few walrus are taken.

At Point Hope there are no great resources to compare with the caribou and walrus at Wainwright, but the sealing and whaling conditions are probably some of the best in this portion of the Arctic. Thus one expert hunter

# EQUIPMENT FOR SEA ICE HUNTING



An Eskimo hunting seals at an open crack. Several seals have been sleeping on the ice bordering the crack, as shown by the markings in the snow.



A group of seal hunters waiting along a wide ice apron at the lead edge. The man in the foreground carries a manak and unaak. The ice upon which he is walking was rafted while very thin, several days before this photograph was taken.

who put in his maximum effort killed 200 seals in the winter of 1964-65, about the same as was accounted for by all of Wainwright during the same winter. In Point Hope the ringed seals are very abundant during the winter but, unlike Wainwright, are not taken at all once the ice leaves in June. The more northern village appears to possess a more balanced and perhaps a more productive economy, but as an overall impression, does not put nearly the initiative into exploiting it.

Seal meat is a source of food for both humans and dogs, and provides skins which are valuable for clothing and for outside sale. For dog food less weight of seal meat is required than of most other types, and the blubber helps dogs to stay warm during fierce winter gales. Eskimos eat all of the meat, the liver, intestines, and kidneys of the seal, either frozen or cooked. The blubber is most important, however, because from it they make oil which is one of the most preferred foods. At Point Hope it is also important for fuel. The meat is considered an excellent emergency food for drift ice survival, cut from the bones so that it will be lighter, and eaten raw and frozen.

The women butcher seals after they are brought home, and usually after being left frozen outside on a meat rack for a few days. The skin is removed first. It is slit along the belly from the chin to the anus, and then it is quickly sliced away with the blubber attached. The skin of the four flippers is not removed, and they are cut from the skin after it is off the carcass. The blubber will be taken off the hide later with the woman's knife (ulu). The thoracic cavity is opened by cutting out the sternum and several inches of the adjacent ribs, and the flesh over the abdomen is cut away. The internal organs are then removed. The rest of the meat is cut away, removing the fore and hind limbs at the girdles, cutting the ribs out, sectioning the vertebrae, and butchering each portion into smaller pieces by cutting at the various joints. An extraordinary knowledge of anatomy is shown as the Eskimo woman cuts the entire seal into smaller and smaller sections without even cutting or breaking a bone.

Seal skins (netchich aminich, or uguruich aminich) are either prepared with the hair on or may be made into naloak, removing the hair and bleaching by hanging outside in the cold and wind. At Point Hope many people hunt seals and prepare the skins as a major source of income, since a prime winter skin brought over 20 dollars in 1964.

## Open Lead Hunting and Culture Change

When firearms were introduced, they were substituted for the harpoon in each of the methods of hunting seals, but the techniques remained

basically the same. Only in the method of open lead hunting was it necessary to evolve extensively different or new technological materials. The material changes were quite important, and the effects upon the economy, the types of activities pursued, and the ecology were extensive and profound. The rifle made available to the Eskimo a resource which he had never before been able to utilize with any degree of proficiency: animals at the open leads of the sea ice.

There was traditionally some effort put into hunting at the water's edge. During the spring the seals migrate northward, following the edge of the lead, and also at this time they have a habit of "sleeping" in the water for several minutes at a time with their head laid back and nose pointed skyward. Each of these behavior patterns was depended upon for open lead hunting with the harpoon. In the case of the springtime "sleeping", it was sometimes possible to sneak close enough to the edge to harpoon the seal.

Hunters also used to build blinds with blocks of ice or snow right at the edge of the lead. Inside of these concealing walls they would wait for an unwary seal to come by or to begin to "sleep", watching through the chinks between the blocks. When this happened they would rise and harpoon the seal, and then run back away from the edge with the line in hand. The seal would struggle to go down or to swim away, but eventually had to rise for air. As it did the line would slacken and the man would pull it toward him, drawing the animal inward. Thus it would surface right next to the edge of the ice, where the hunter killed it with a club made from a heavy round rock on a wooden handle.

Such a method, limited to open-water periods, mostly done in the springtime, and probably not more productive than breathing hole or sleeping seal hunting, would not be a particularly favored one. This is especially true since during the same season there was also seal netting going on. Therefore the only real attraction of open water would be for the spring whaling, and the general situation would compare to that described by Boas (16) for the central Arctic:

> The immense land floe of Davis Strait is not so valuable a hunting ground for the Eskimo as Cumberland Sound, the ice being very rough a few miles from the coast and at some places even close inshore. When the sea begins to freeze in the fall the newly formed ice is broken up by severe gales and by the currents and is piled up into high hummocks before it consolidates. The sealing on rough ice during the winter is very difficult and unsuccessful, as it is hard to find the breathing holes and the travelling is very laborious. It is only in the northern parts of Home Bay and

> in the large fjords that smooth ice is formed we find that natives either are settled or have been settled. . . . On the long shores between them [the bays], which are unsheltered from winds and currents, the ice is always very hummocky, and, therefore, the natives do not settle upon them in the winter [4].

And further on he writes specifically with reference to the use of open water. Note that he states definitely that seals are hunted on the solid ice near the open water, but does not make any reference to actual open-water hunting:

> There are only a few districts where the proximity of open water favors walrus hunting during the winter, and all of these have neighboring floes on which seals may be hunted with the harpoon. . . . As to the remainder the Eskimo live altogether independent of the open water during the winter (16)[5]

A later reference to open-water sealing is of particular interest:

> Whenever water holes are found they are frequently visited during the winter by the Eskimo, especially by those who have firearms. They lie in wait at the lower side of the hole, i.e., the side to which the tide sets, and when the seal blows they shoot him, securing him with the harpoon after he has drifted to the edge of the ice (16)[6].

The same method is described for the Barrow natives by Murdoch (6), while a brief description of harpooning seals at leads is given by Nelson (2) for the Bering Strait region. In this case Nelson simply states that if a man harpoons a seal from the ice edge and for some reason cannot hold it, he lets go, with the linestand for a drag at the end of the line, and chases it with his kayak.

It seems possible, in view of a brief survey of the literature, that a similar situation to that described by Boas (16) for the late 19th century central Arctic might have been present in the northwest Alaska before the introduction of firearms. It may be the case, and perhaps archaeological surveys will some day offer evidence, that formerly there were settlements all along this coast and the area to the south, without the preference for

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4 Boas op cit. Reprinted by permission.
5 Ibid
6 Ibid

points and headlands that is seen in the modern settlement pattern. In this case there would be sites of inhabitation scattered everywhere during the winter, all around the bays as well as on exposed coasts, in areas of flat unmoved ice (viz., the site of the modern village of Kotzebue) as well as those areas where the ice is continually in motion. Larger settlements would be present at localities such as Point Hope and Point Barrow because of an abundance of seals, available by various harpooning methods, but more so because of the excellent whaling which provided a resource beyond that available to the more protected settlements. These areas would see temporary expansion of population in the whaling season due to arrival of people from inland and from protected coastal settlements.

But the introduction of firearms would have altered this pattern by making hunting at open leads a focus of interest rather than a minor activity. As rifles became more readily available and knowledge of this new method of hunting expanded, there may have been a tendency for people to spend the mid-winter months in exposed localities where they now could take more seals than ever before. Since that time this pattern has become increasingly prevalent, with people eventually giving up living inland and at protected coastal localities. Of course these movements were influenced to a greater degree by the disappearance of the caribou, introduction of disease, and attraction of various advantages of the white influence. And as the method of open lead hunting took hold, the other methods such as netting and breathing hole hunting were abandoned. All of this took place in a span of 100 years.

If there is question about the validity of the preceding hypothesis, there can be no reason to doubt that some significant changes in native technology took place due to the use of firearms. Of course there are items which have become extinct or at best vestigial remnants. These include the harpoon itself, with associated skills of ivory carving, flint chipping, and so on. And there are items such as the sealing stool, seal nets, and many miscellaneous objects. And there have been secondary losses, both materially and economically, caused by the decrease of effort expended per amount of game required.

There are additional changes in items previously in existence, and a few entirely new devices have evolved. Some of these have been discussed in an earlier section dealing with the use of dogs. An obvious change has also taken place because in the days when seals were harpooned there was no need to retrieve them. The head of the harpoon had a line attached to it, which automatically took care of that problem. And so, first of all, the manak and niksik retrieval hooks either were invented or were modified from a previously used item. Secondly, the umiahalurak in Wainwright was brought north from Teller early in the 20th century. The man

who brought the boat is still alive and is the one who told of it. He suggested that the small boats were used to the south for setting nets, and then after their introduction in the north, became popular for retrieving seals.

The kayak, pronounced kayaḳ in Eskimo, had been modified for use as a retrieval device before the arrival of the umiahalurak, which has now almost replaced it. During Murdoch's stay at Barrow (1881-1883), the kayaks were similar to the "old-time" kayaks described by elderly informants. These sleek boats were 17 to 19 feet long and little over 20 inches wide, with a U-shaped cross section. They were used mostly for caribou hunting inland, but also to some extent for short trips between camps along the coast, for setting nets, for hunting flightless moulting waterfowl, and for harpooning seals in the open ocean. No mention is made in this reference (6) or in any of the other early works on this region, of short boats of any type, open or decked.

After the introduction of firearms these long kayaks began to disappear very rapidly, being replaced by a shorter and wider type used during the winter, when the older long type was never used. This new type, called kayapak or kayapaurak because it is short and wide, became so popular that "almost every man" had one. There was a fair amount of variation in the length and width, depending upon the preference of the individual, ranging between 9 and 12 feet in length, and 2 to 3 feet wide. Basic design, with an upturned foredeck, slanted cockpit rim, flat rear deck, rounded U-shaped cross section, and so on, was retained. The details of construction were also little changed. Associated with the evolution of short boats for carrying by hand or on dog sleds (hand sleds mentioned by Point Hope informant), was the use of the niksigaurak for pulling seals to the ice edge. The kayaks were also used for retrieving shot waterfowl and for setting nets, but these were purely secondary functions and not responsible for the decrease in length of the boat.

A long boat cannot be carried regularly on a dog sled because it is cumbersome and would quickly break. Associated with the danger of breakage is the use of resilient baleen for ribs, which was popular for the little kayaks. For a brief period of 50 years the kayapak was used in the villages from Barter Island to Barrow and south beyond Point Hope, where it now survives as a remnant in every village except Point Hope, and perhaps Point Lay. Why was this boat given up in favor of the open skin boat?

There are several reasons for this. According to the Eskimos the umiahalurak is easier to enter and leave, is less likely to be caught in young ice, can be used to rescue several men or a man and some of his dogs from drifting ice, and is not as tippy as the kayak. Although several

reasons are given, the latter one is the really important one. The northwest Alaskan Eskimos nurture an almost pathological fear of the kayak. Whether this is simply a rationalization which explains the change most easily, covers up for the fact that kayaks are just too difficult to build compared to the popular open boat, or has arisen for some other reason, the writer cannot guess. The kayapak is in actuality probably one of the most stable kayak designs used by any Eskimo group, and for the learner it is no more difficult to master than the umiahalurak. The writer found that the open skin boat was, in fact, more difficult for him to use than the kayak, although his previous experience was with kayaks.

The reason for this lack of skill is apparently historical in part, as evidenced by this quote from Murdoch's study at Barrow in the late 19th century (6):

> Although nearly every male above the age of boyhood owns and can manage one of these canoes [long-type kayak], they are much less generally employed than by any other Eskimo whose habits have been described, except the 'Arctic Highlanders', [Polar Eskimos] who have no boats, and perhaps those of Siberia and their Chuckchi companions. The kayak is used only during the season of open water, and then but little in the sea in the neighborhood of the villages.

It is noted also that, although they were "skillful and confident", they did not use the kayak in rough seas. This material apparently shows that the use of kayaks was not favored historically, and culturally was not considered important. Therefore it becomes more clear, given the other advantages of the open retrieving boat, why there are now no kayaks in Point Hope where they were used in the recent past, only three still in use at Wainwright, and a few at Point Barrow. Young men at Wainwright and many of the middle-aged hunters, do not know how to use them and are afraid of them. There is no future for the kayak in this region, and few of these now in existence will have new skins put on them many more times. The umiahalurak is still growing in popularity and will remain in use until the men no longer hunt.

## XIX

## LOSS OF HUNTING SKILLS AT WAINWRIGHT

The skills and knowledge which had been developed during the early centuries, began to degenerate soon after the first whaling ships sailed these coasts. The processes of culture loss and acculturation which are

involved in the changes in this aspect of native life are too complex and interrelated to be discussed without specific study. However it is undoubtedly true, in recent years at least, that the availability of food and material goods from "outside" is the most important factor affecting the native economy. During the earliest periods only minor supplementary items were acquired through fur trade; but trapping diverted attention from the activities which formerly were important during the mid-winter period. In addition to the few items of food which were purchased, firearms became available, which caused the most revolutionary changes.

It is impossible to say just why the natives began to relax their formerly ambitious quest for game in favor of an increasingly lazy approach to the problem of acquiring their daily fare. Of course with the rifle less effort was required to obtain the same amount of game. This left more time available for the pursuit of the new cash economy, which in turn made it possible to get imported foods. And there were some minor contributions to the trend, such as the missionaries' introduction of the Sunday hunting taboo, which is enthusiastically followed to this day.

Although these processes started early, the older Eskimos of today still possess a great knowledge of traditional culture and were, in their prime, nearly as skillful as their parents. But their knowledge has been transmitted only in part to their children. There are several reasons for this: First, native social culture and tradition have been severely criticized by outsiders such as whalers, traders, and missionaries, which exterminated some of it and drove the rest "underground". The effects of the loss of social culture, which supported and augmented economic and material culture, are partly responsible. Second, the sons of men who are now old have, for some reason unknown to the writer, become unwilling to put forth the effort required to derive complete support from hunting, and at the same time have acquired only some of the skills and knowledge which their fathers consider necessary to be an expert hunter.

These men, 30 to 50 years old, are content to be only semi-proficient hunters, extracting their principal livelihood from hunting, but also requiring considerable cash in order to purchase canned foods and a wide range of manufactured goods. These "outside" materials could easily be had without such extensive loss of native skills, a loss which has been especially heavy with regard to willingness to expend energy and time in hunting.

But although the adults of today are no longer the hunters that their fathers were, they still are proficient and knowledgeable enough to get along quite well in the environment. And if it were necessary they could

derive their entire livelihood from hunting, although they would not like it. The greatest change and the heaviest loss of Eskimo culture is perhaps not occurring within this middle generation, but in the generation of their children, and to some extent their younger siblings. There are two factors operating in this young generation which will all but destroy the native economy and will place these men and women in a state of cultural nirvana. Most important of these is education, and a second factor, child training practices, is actually closely connected or dependent upon the first.

The youngsters 25 years old and under have not had a chance to acquire more than a rudimentary knowledge of Eskimo economic culture. At five or six years of age they begin to spend six hours each day in school, and the remainder of their waking hours are occupied by play activities with other children. There is very little communication between adults and children, which is a traditional holdover, and almost no opportunity for youngsters to accompany their elders for hunting activities even if the interest on either part were there. So the child spends eight or nine years in school within the village, during which time he acquires little more than a beginning knowledge, and even less interest, in Eskimo culture.

Then, at 14 to 16 years of age he either finishes school or leaves the village for four years of high school. Individuals with any promise leave the village at this time, either to return after four years without the least interest in being an Eskimo, or to find employment "outside". Those who do not go out to high school are youths with less intelligence and ability; young men with little or no promise as students and equally small aptitude for hunting. So consider the 18-year-old who returns from the relatively cosmopolitan life at Mt. Edgecumbe High in Sitka. The village still attracts and holds him because it is the friendliest place he knows, but he will not learn to struggle in the cold of the Arctic just for the sake of seals and caribou. He has never acquired a system of values which would make him want or need to, nor the intricate behavior that would enable him to hunt.

The few of them who are willing to put forth some effort are promptly set against it because of the sometimes brutal methods of training. Although in former years there was some verbal instruction of youths by older men, there seems to have been, and still is today, a greater emphasis upon practical "on the job" training. The young hunter accompanies older men on their hunting trips and learns by observing them. If he succeeds in duplicating their actions properly, he is rewarded by silent acceptance. If he should make an error, on the other hand, he is chastized and teased. This ridicule continues beyond that which takes place at the time, and the other hunters are told of his failings later so that they can join in.

The system is very effective, and makes the youth even more determined to succeed under normal conditions of cultural stability. For example, any man who becomes lost or should happen to allow his dog team to run away from him is ridiculed and is considered something of a fool. The thought of such ridicule forces the Eskimo to learn his navigation skills well and to exercise caution whenever he travels. He consciously wishes to escape humiliation because of such errors, and thus, almost unconsciously, assures that he will probably not face the grave dangers caused by them.

Today the system is the same, but the response is different. In Wainwright there was only one man in this age group who was willing to learn the skills of hunting. There were many others who did not know them and were not willing to undergo the tribulations involved in learning them. This is partially due to the methods of training: the physical and psychological difficulties of learning to hunt. The young man must be able to shrug off continual ridicule and teasing for his errors, and seldom is able to strike a counterblow. The would-be hunters of the past have been required to endure this "hazing" treatment because for them there was no alternative. Today, however, the youth who returns to the village after completing his formal education is, in the first place, not interested, and must in addition face the continual frustration of a learner if he does attempt to hunt. In the past there was no alternative but to undergo the painful process, but today he can leave the village, find a job in the village, or live as an unproductive consumer.

The sadly beneficent government has made it easy for men to live without being self-sufficient. The Wainwright Eskimos are very proud of being Inupait ("Real People") but see no loss of pride in accepting monthly welfare checks. Therefore the government and the other villagers support various individuals who do not hunt. In fact, even the most active hunters accept this easy money. Welfare is another factor which is destroying the initiative of even the older hunters, and is aiding in the breakdown of incentive. It is obvious, therefore, that native economy will die with the passing of the present adult generation.

And along with it will be lost the fascinating and impressive body of knowledge which has been developed for these hundreds of generations. It is fortunate that we realize ahead of time that there is considerable practical value, to say nothing of the limitless intrinsic worth, in the recording of such information. But we must put forth, in the next few years, a maximum effort to collect and observe what we still can, before it is lost in the icy graves of the old men.

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13. ABSTRACT Studies were conducted mainly at the Eskimo village of Wainwright, Alaska, with supplementary research done at Point Barrow and Point Hope. A primary aim was to gather information concerning survival on the sea ice by a systematic study of both contemporary and traditional Eskimo hunting, travel, and other sea ice practices. Principal emphasis of the study was on observation and participation, with informal interviews utilized whenever actual hunting and travelling were not going on. The author lived as closely as possible to the native pattern. Data is organized in terms of environmental phenomena or "stimuli" likely to occur in the Arctic, and activities or "responses" which the sea ice traveller must make in order to cope with these external forces or to utilize resources which the environment provides. These forces are divided into (1) physical environment, including temperature, wind, atmospheric phenomena such as clouds and snow, astronomical phenomena such as sunlight and aurora, and sea ice; and (2) biological environment which the Eskimo exploits on the sea ice, including invertebrates, fish, birds and mammals. Since the Eskimo has become exposed to "outside" influence, much of the traditional culture is being lost, and the introduction and use of firearms caused revolutionary changes in hunting methods. Today the Eskimo combines traditional and modern practices in surviving in and exploiting the sea ice environment.

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